VOL. 78. PART 2 FEBRUARY, 1954

AD.
OMMONWEALTH DEPT.
NTOMOLOGY LIBRARY
11 MAY 1954
ERIAL Aus. 17
EPARATE

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL

A Queensland Beekeeper at Wo

LEADING FEATURES

Rhodes Grass
Cattle Country of the Central Highlands
Arsenical Poisoning
Irrigation Practice
Marketing Passion Fruit
Vitamin A
Still More Wool!

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

DEPARTMENT OF AGRICULTURE AND STOCK.

ORGANISATION OF ADVISORY AND TECHNICAL SERVICES.

Under Secretary	A. F. Bell, M.Sc., D.I.C., A.R.A.C.I.
Assistant Under Secretary (Technical)	R. Veitch, B.Sc.Agr., B.Sc.For., F.R.E.S.
Assistant Under Secretary	W. T. Gettons, A.I.C.A.
DIVISION OF PLANT INDUSTRY—	
Director, Division of Plant Industry	W. A. T. Summerville, D.Sc.
Agriculture Branch—	
Director of Agriculture	W. J. S. Sloan, M.Sc.Agr.
Horticulture Branch—	
Director of Horticulture	S. A. Trout, M.Sc., Ph.D.
Regional Experiment Stations Branch—	
Director, Regional Experiment Stations	W. G. Wells
Chemical Laboratory—	
Agricultural Chemist and Biochemist	M. White, M.Sc., Ph.D., A.R.A.C.I.
DIVISION OF ANIMAL INDUSTRY—	
Director, Division of Animal Industry	W. Webster, B.V.Sc.
Assistant Director	A. L. Clay, B.V.Sc.
Veterinary Services Branch—	
Director of Veterinary Services	C. R. Mulhearn, B.V.Sc.
Animal Health Stations—	
Director of Research	J. Legg, B.Sc., D.V.Sc., M.R.C.V.S.
Sheep and Wool Branch—	
Director of Sheep Husbandry	G. R. Moule, B.V.Sc.
Cattle Husbandry Branch—	
Officer in Charge	R. D. Chester, B.V.Sc.
Pig Branch—	
Officer in Charge	F. Bostock
Poultry Branch—	
Officer in Charge	P. Rumball, R.D.A.
DIVISION OF DAIRYING—	
Director of Dairying	E. B. Rice, Dip.Ind.Chem.
Research Branch—	
Director of Research	L. E. Nichols, B.Sc.Agr., A.R.A.C.I.
Field Branch—	
Director of Field Services	R. A. Paul, B.Sc.Agr.
DIVISION OF MARKETING—	
Director of Marketing	H. S. Hunter
Assistant Director of Marketing	C. H. P. Defries, H.D.A., B.Com., A.F.I.A.
Standards Branch—	
Standards Officer	F. B. Coleman
CLERICAL AND GENERAL DIVISION—	
Information Branch—	
Officer in Charge, Information Services	C. W. Winders, B.Sc.Agr.

NEW SEASON'S FLOWER SEEDS

HAVE JUST ARRIVED FROM THE WORLD'S LEADING GROWERS.

SWEET PEAS.—In many varieties, including all newest and best varieties, from 9d. to 3/6 packet.

PANSIES.—Englemanni, Special Prize strain; Westland Giants; Roggli Giants, etc., from 1/2, 2/6 and 3/6 packet.

PRIMULA.—Malacoides, in pink and red shades; also Obconica, the lovely large ornamental pot plant variety.

ICELAND POPPIES.—Gartford strain, Unwins, Giants and Imp. Sunbeam variety.

Also STOCKS, VIOLAS (lovely Border plants), ANTIRRHINIUMS, CALENDULAS, STATICE and many others.

THOS. PERROTT & SONS

337 GEORGE STREET 272 QUEEN STREET 38 BOWEN BRIDGE ROAD
BRISBANE

Phones L2788, B7358, B4952. G.P.O. Box 622J, Brisbane.

Contents

	PAGE.
Field Crops—	
Irrigation Practice in Queensland. Part 1. Requirements for Successful Irrigation	63
Agricultural Standards—	
"*The Agricultural Standards Act of* 1952." Registration of Limes	67
Pastures—	
Rhodes Grass	71
Fruit Growing—	
Preparing Passion Fruit for the Fresh Fruit Market	81
Approved Strawberry Runners	88
Agricultural Chemistry—	
Vitamin A and Livestock	89
Beekeeping—	
The Honey Flora of South-eastern Queensland	91
Sheep and Wool—	
Still More Wool! Part 1. Introductory	95
Cattle Husbandry—	
The Cattle Country of the Central Highlands	103
Animal Health—	
Arsenical Poisoning of Stock	114
Pig Farm—	
Using Home-grown Food for Pigs	117
Dairy Industry—	
The Manufacture of Cheddar Cheese in Queensland	119

IMPORTED SEED OATS

CLEANED — CLIPPED — GRADED

Guaranteed to pass exacting purity and germination standards.

TRUE TO TYPE—FREE OF ALL WEEDS—HIGH GERMINATION

ALGERIANS BELARS FULGHUMS
MULGAS BURKE KURRAJONGS

ALSO QUEENSLAND RUST RESISTING
VICTORIA x RICHLAND and BLIGHS

High Testing Hunter River and South Australian Strain Lucerne Seed.

BARLEY, BROOM MILLET, CANARY, POONA PEAS, MILLETS, RYE, PASPALUM, PRAIRIE, RHODES, PUMPKIN, RAPE, SORGHUM, SACCALINE, SUDAN, SUNFLOWER, SWEDES.

Manufacturers of Stock and Poultry Foods.

STATE PRODUCE AGENCY

PTY. LTD.

266-274 ROMA STREET . . . . BRISBANE

Tuberculosis-Free Cattle Herds.

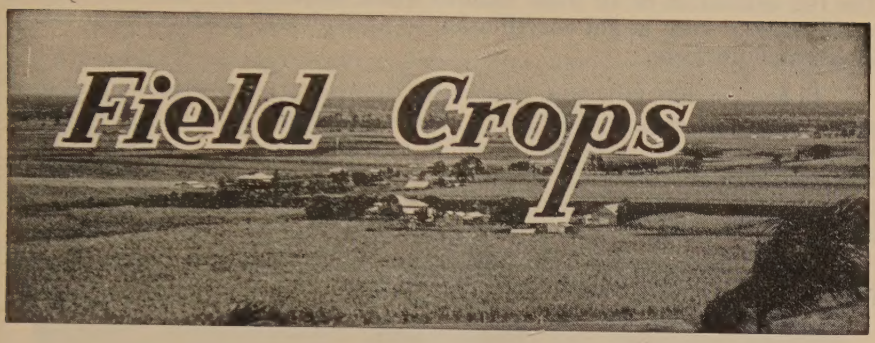
TESTED HERDS (As at 15th January, 1954).

The Tuberculosis-Free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements.

The studs listed here have fulfilled the conditions to the date shown above.

Full particulars of the scheme and Agreement for Testing forms may be obtained from the Under Secretary, Department of Agriculture and Stock, Brisbane, or from Divisional Veterinary Officers throughout the State.

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus" Stud, Greenmount H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy Sullivan Bros. "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer" Stud, Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest" Stud, Wondai W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman W. H. Thompson, "Alfa Vale," Nanango S. R. Moore, Sunnyside, West Wooroolin H.M. State Farm, Numinbah D. G. Neale, "Groveley," M.S. 195, Pittsworth Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah W. D. Davis, "Wamba" Stud, Chinchilla Queensland Agricultural High School and College, Lawes C. K. Roche, Freestone, Warwick
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount J. F. Lau, "Rosallen" Jersey Stud, Goombungee G. Harley, Hopewell, M.S. 189, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango F. W. Verrall, "Coleburn," Walloon C. Beckingham, Trouts road, Everton Park W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala G. H. Ralph, "Ryecombe," Ravensbourne Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah C. A. Edwards, "Grasmere" Jersey Stud, Woodford Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
Polled Hereford	W. Maller, "Boreview," Pickanjinnie J. H. Anderson, "Inverary," Yandilla D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick



Irrigation Practice In Queensland.

Part 1. Requirements for Successful Irrigation.

A. NAGLE, Irrigationist, Agriculture Branch.

Irrigation practice may vary from supplying all the soil water required for growth of crops, as happens in arid regions, to supplying any deficiency of soil moisture during limited periods when rainfall is inadequate for normal crop growth. Where irrigation is applied occasionally to supplement rainfall, the term " supplemental " irrigation is commonly used.

All irrigation carried out in Queensland at the present time and the large-scale development of irrigation contemplated in this State would come under the general category of " supplemental " irrigation.

A study of rainfall in the agricultural areas of Queensland reveals a shortage of total annual rainfall for most crop requirements. Moreover, the incidence of monthly or seasonal rainfall is frequently so variable that the hazard of partial or complete crop failure is ever present, except in some few favoured coastal areas with high rainfall. Even in these areas, there are seasons when irrigation would be useful to promote maximum crop growth.

In seasons when total rainfall is at or above average in most districts of Queensland, dry periods are still likely to occur during a critical stage of plant growth. Where irrigation facilities are available, reduction of crop yield from this cause can be prevented.

The advantages of irrigation have been repeatedly demonstrated during recurrent drought periods. Irrigation as a safeguard or insurance against periodic droughts is of special value, as not only crop losses but also heavy losses of valuable stock can be avoided by the farmer who has supplemental irrigation at his command. The farmer with irrigation facilities is not only insured against drought, but he is assured also of maintaining a high level of production and thus stabilising his output whether in the form of dairy produce or agricultural crops or both.

The development of large-scale irrigation projects in Queensland will play an important role in the stabilization of agricultural production. A much wider use, however, could be made in many localities of existing water supplies from rivers and creeks and of water obtainable at shallow depths from wells and bores. An appreciable increase in agricultural production could follow development of known underground water supplies.

The full utilization of all these natural water resources by individual units could make a very useful contribution to agricultural production in many Queensland districts.

As the combination of suitable soils adjacent to adequate supplies of good quality water is limited, every endeavour should be made to use these natural resources to the best possible advantage. The outline of basic irrigation information to be published during the next few months is provided to assist the farmer who has installed or is contemplating the installation of an individual pumping plant.

The requirements for successful irrigation are briefly discussed in the following sections.

Suitable Soils.

A wide variety of soils, varying from heavy clay to deep sandy soils, may be used. The soil type determines the crop or crops which can be grown successfully with irrigation and may influence the selection of the method of irrigation which can be employed most economically.

The slope and topography of the land must be considered in connection with soil type in deciding cropping programme and irrigation method to be used.

Water Supply.

The volume of water available will determine the area which can be irrigated, the method of irrigation to be employed and to some extent the crop grown.

With border irrigation a delivery of one cusec (that is, approximately 22,600 gallons per hour) is required to give effective control of the water applied when large areas are to be irrigated. With spray irrigation, a delivery rate of even a few hundred gallons per hour can be utilised successfully for annual market garden crops. Permanent crops such as lucerne and pastures have a high water consumption and require watering at frequent intervals. Summer-grown annual crops or annual pastures which require one or two seasonal irrigations have a relatively light water demand. Annual crops such as tobacco and tomatoes when grown in the dry months of the year may have a high water requirement.

The quality of the irrigation water is most important, as damage to the crop and permanent damage to the soil may result from the use of unsuitable water. It is strongly advised that before commencing irrigation, particularly where the supply is from a well or bore, a sample should be forwarded to the Department of Agriculture and Stock for analysis and advice as to the suitability of the water which it is proposed to use.

Suitability or otherwise is determined by the amount of injurious salts contained in the water. Usually water containing 80 grains or upwards of common salt per gallon is unsuitable for irrigation except for certain crops of high salt tolerance growing on well-drained soil.

Drainage.

Effective drainage is a prerequisite of any successful irrigation layout. Without drainage facilities, surplus irrigation and storm water tends to accumulate on the land and causes not only loss of crop through waterlogging but also damage to the soil by the accumulation of a harmful concentration of salts.

Plate 1.

A Perforated Pipe Spray Line in Operation in a Market Garden.

Plate 2.

Furrow Irrigated Tobacco at Clare, on the Burdekin.

Surface drainage of excess water to a natural outfall or watercourse is necessary, and this aspect should receive careful consideration in the initial planning.

Drainage water conveyed to a lowlying area or swamp may be utilized by planting the area to water-tolerant pasture grasses, such as paspalum and para grass.

Layout.

A layout suitable for the type of irrigation to be undertaken is essential. As each irrigation project needs individual planning, the advice of a competent person should be obtained when contemplating the installation of irrigation facilities, otherwise very costly mistakes may be made.

The agricultural field staff of the Department of Agriculture and Stock can give valuable assistance to farmers who are irrigators or about to undertake irrigation farming, and the Irrigation and Water Supply Commission has a Farm Advisory Service. The services of both these Departments should be fully utilized prior to commencing any irrigation project.

Pumping Facilities.

The installation of a high-efficiency pump with a power unit, in the form of either an electric motor or an internal combustion engine, of sufficient power to deliver the required quantity of water, whether the source be well or watercourse, is of paramount importance.

Where electric power is readily available, the relatively low cost of an electric motor would favour this form of power, especially where pumping is intermittent. Where electric power is not available and where pumping is expected to be more or less continuous, the installation of a diesel power unit may be advantageous. The type of pump required will vary with the lift required. For deep wells or bores the deep well turbine pump has certain advantages, such as ease of installation. Reliable advice should be sought for any contemplated installation of power unit or pump.

Licence to Operate Pump.

When irrigation water is to be pumped from a watercourse or stream, application for a permit for this purpose must be made to the Irrigation and Water Supply Commission, Brisbane. A restriction may be imposed on the size of pump permitted for irrigation purposes.

A SPECIAL RADIO SERVICE FOR FARMERS

★ ★ ★

The COUNTRY HOUR, a special service for farmers, is broadcast DAILY through the National and Regional Stations from 12 to 1.

"The Agricultural Standards Act of 1952."

Registration of Limes.

F. B. COLEMAN, Standards Officer, Standards Branch.

The following definitions are set out in "*The Agricultural Standards Act of* 1952" :—

"*Lime.*"—Any material containing lime used or intended for supplying lime in the practice of agriculture. The term includes magnesium limes, dolomite, and gypsum.

"*Neutralising Value.*"—Used with reference to any prescribed material or any ingredient of any agricultural requirement, means capacity to neutralise acidity (such capacity to be ascertained by the prescribed method).

Registration.

Before any lime is placed upon the Queensland market, an application for registration must be made by the Queensland primary dealer and such application renewed every three years, *i.e.* 1956, 1959, &c., during the month of January. Registration fees are payable annually. No sales should take place until registration has been effected.

Application for registration or re-registration involves forwarding to the Standards Branch a statutory declaration, setting out the formula of the preparation, a specimen label and the necessary fee of £1 for each preparation. Registration is effected when the requirements of the Act are satisfied.

Labels.

Each lime label must set forth—

Name of the lime ;

Net weight contained in the package to which it is affixed ;

All directions or recommendations for use, if any ;

A statement setting out—

(*a*) the names and respective percentages of active constituents and the form or forms in which they occur, for example :—

.....% Min. Lime (CaO) as .....

.....% Min. Magnesia (MgO) as.....

(*b*) the neutralising value, except in the case of gypsum ;

(*c*) the degree of fineness set out as—

.....% Fine
.....% Coarse } Not required for burnt or slaked lime.

Name and sole or principal place of business of the primary dealer or manufacturer, proprietor or distributor.

The details required on labels or packages should be legibly and indelibly printed by a printing press.

LIME FOR AGRICULTURAL PURPOSES.

REGISTERED UNDER THE AGRICULTURAL STANDARDS ACT OF 1952 AS AT 5TH OCTOBER, 1953.

Name.	Guaranteed Analysis.						Name and Address of Dealer.
	(CaO) Lime.	In the Undermentioned Form.	Magnesia (MgO) as Magnesium Carbonate.	Neutralising Value.	Fine.	Coarse.	
	Min. %		Min. %	Min. %	Min. %	Min. %	
BURNT LIME.							
A.C.F. Burnt Lime	90	As Oxide ..	..	160	..	..	A.C.F. & Shirleys Fertilizers Ltd., Brisbane
Ambrose Burnt Lime	90	As Oxide ..	..	160	..	..	Ambrose Lime Works Pty. Ltd., Ambrose
Crotty's Burnt Lime	90	As Oxide ..	..	160	..	..	E. M. Boden & Co., Cairns
Ryan Burnt Lime	90	As Oxide ..	..	160	..	..	North Australian Cement Ltd., Calcium, G.N.R.
Ryan Crushed Burnt Lime ..	90	As Oxide ..	..	160	..	..	North Australian Cement Ltd., Calcium, G.N.R.
Tamaree Burnt Lime	82·5	As Oxide ..	..	151	..	..	Tamaree Lime Works, Gympie
HYDRATED LIME.							
A.C.F. Hydrated Lime	70	As Hydroxide	..	125	..	..	A.C.F. & Shirleys Fertilizers Ltd., Brisbane
"Limil"	65	As Hydroxide	3·0	123	..	..	Brett & Co. Pty. Ltd., South Brisbane
SLAKED LIME.							
Ryan Slaked Lime	65	As Hydroxide	..	116	..	..	North Australian Cement Ltd., Calcium, G.N.R.
Tamaree Air Slaked Lime	2·5 34·3 18·6	As Oxide .. As Hydroxide As Carbonate	..	124	..	..	Tamaree Lime Works, Gympie
PROCESSED LIME.							
Acco Processed Lime	47	As Carbonate	..	88	35	65	Australian Chemical Co. Pty. Ltd., South Brisbane
Processed Lime	47	As Carbonate	..	88	50	50	T. Mewing & Sons, Brisbane

PULVERISED LIMESTONE.							
A.C.F. Pulverised Lime	50	As Carbonate	..	90	50	50	A.C.F. & Shirleys Fertilizers Ltd., Brisbane
Agricultural Lime	50	As Carbonate	..	90	60	40	H. J. Richards & Sons, Toowoomba
Ambrose Pulverised Limestone ..	50	As Carbonate	..	90	84	16	Ambrose Lime Works Pty. Ltd., Ambrose
Crotty's Pulverised Limestone ..	51	As Carbonate	..	92	77	23	E. M. Boden & Co., Cairns
F.D.L. Pulverised Limestone ..	52	As Carbonate	..	95	70	30	Fertiliser Distributers Pty. Ltd., Brisbane
F.D.L. Garden Lime	52	As Carbonate	..	95	70	30	Fertiliser Distributers Pty. Ltd., Brisbane
Highest Quality Farmers' Lime (Pulverised Limestone)	55	As Carbonate	..	99	75	25	Texas Lime Works, Hamilton road, Chermside
Pulverised Limestone	50	As Carbonate	..	90	65	35	Northern Lime Co., Mossman
Ryan Pulverised Limestone ..	50	As Carbonate	..	85	50	50	North Australian Cement Ltd., Calcium, G.N.R.
Tamaree Ground Limestone ..	49	As Carbonate	..	89	80	20	Tamaree Lime Works, Gympie
EARTHY LIME.							
Bowen Earthy Lime	35	As Carbonate	..	60	70	30	Magnemac Pty. Ltd., Don road, Bowen
Didcot Earthy Lime	40	As Carbonate	..	75	85	15	Didcot Lime Co. Pty. Ltd., Maryborough
Earthy Lime	50	As Carbonate	..	90	90	10	C. R. Ambrose, Marmor
Magnesian Earthy Lime	43	As Carbonate	7·0	85	60	40	Inkerman Lime Co., Home Hill
Ryan Earth Lime	48	As Carbonate	..	85	50	50	North Australian Cement Ltd., Calcium, G.N.R.
Webb & Webb Pulverised Earthy Lime	42	As Carbonate	..	75	65	35	Reid River Lime Co., Reid River
MAGNESIUM LIME.							
Harvest Dolomite	26	As Carbonate	11·0	78	80	20	Mineral Industries & Ores (Q'ld.) Pty. Ltd., Brisbane
Harvest Dolomite No. 2	22	As Carbonate	14·0	70	80	20	Mineral Industries & Ores (Q'ld.) Pty. Ltd. Brisbane
"Ibis" Dolomite	21	As Carbonate	18·0	78	50	50	The Ibis Dolomite Coy., Brisbane
"Ibis" Dolomite (S)	19	As Carbonate	16·0	70	50	50	The Ibis Dolomite Coy., Brisbane

Farmers and other buyers would be well advised *NEVER TO ACCEPT DELIVERY* of any lime unless it has affixed to the package a plainly printed label setting out the required information.

In the absence of a label, the buyer should at once communicate with the Standards Branch, Department of Agriculture and Stock, William Street, Brisbane.

The limes as set out in the accompanying list are those that have been registered up to 5th October, 1953, for the three-year period January, 1953, to January, 1956, under the Agricultural Standards Act. These and any published in subsequent lists are the only limes that should be offered for sale or requested by prospective purchasers.

It should be noted that the sale of any unregistered lime would render the seller liable to a penalty not exceeding £100.

Further particulars may be obtained from the Standards Branch, Department of Agriculture and Stock, William Street, Brisbane.

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Rhodes Grass.

Officers of the Agriculture Branch.

Rhodes grass (*Chloris gayana* Kunth) is a native of South Africa and has been introduced for pasture purposes to many subtropical and warm temperate countries. It is believed to have reached Queensland from New South Wales about 1905. It came into favour quickly throughout the Burnett district and on the Atherton Tableland, and was grown as far west as Mitchell, in the Maranoa, by 1912.

During the first decade after its introduction to Queensland, Rhodes grass was sown almost entirely on land cleared of softwood scrub or brigalow scrub. This phase was followed by the planting of much fertile forest country. Rhodes grass also proved of extraordinary value for sowing down on brigalow scrub country reclaimed from prickly-pear by *Cactoblastis cactorum*.

Despite the fact that other grasses such as green panic and buffel are now showing great promise for much of the land previously considered suitable for Rhodes grass, it is clear that Rhodes grass will continue to remain a major species for the sown pastures of Queensland.

Description.

Rhodes grass is a perennial tufted plant with erect flowering stems and spreading surface runners which root at the nodes or joints. So readily are the runners formed that a good ground cover is obtained within a few months of sowing under favourable soil and weather conditions. From each node of the runners are produced leafy stems which may attain a height of over 4 feet under ideal growing conditions. The long flowering stems bear at the top 10—20 radiating brownish-green seed spikes.

Rhodes grass has a vigorous rooting system which penetrates deeply into the soil; thus it possesses an appreciable degree of drought resistance. As a soil renovator it has proved very useful in the 25-30 inch rainfall belt particularly. Rhodes grass pasture established for three or four years on old cultivations has been found to be very beneficial in restoring soil structure and moisture-holding capacity.

Several forms of this grass are characterised by a delayed appearance of the seedheads. While work by officers of the C.S.I.R.O. in Queensland indicates that no advantages are

gained by using a later maturing Kenya strain in preference to the common Rhodes grass strain, there still remains a range of other forms to be tested. Testing of Rhodes grass strains is being carried out in a number of districts in Queensland, and there is a possibility that the common strain may be replaced ultimately by higher yielding types. Seed production of high-yielding types is, however, poor. This will present a problem in using them on a wide scale.

Climatic Requirements.

The grass is primarily a summer grower, making most of its growth during the period October to April. The areas best suited to the grass are those receiving an average annual rainfall of between 25 in. and 50 in., most of which occurs during the summer months. Where the annual rainfall is 60 in. or higher, Rhodes grass becomes spindly in habit and develops yellow leaves due to nitrogen deficiency. The use of Rhodes grass in areas where leaching of plant foods is pronounced will be restricted unless suitable pasture legumes can be combined with it. Districts receiving an average rainfall as low as 22 in. per annum may be suitable for the grass if the distribution of the rainfall is not too erratic.

Rhodes grass has fair drought resistance, although evidence shows that it is not able to withstand severe dry conditions as well as green panic or buffel grass; nor does it make regrowth after drought or during warm spells in the winter months as quickly as these two grasses. Cool weather retards growth and it is susceptible to damage by severe frosts unless a thick protective blanket of top-growth is present.

Soils.

The grass grows well on a variety of soil types, but thrives best on loams, ranging from sandy loams of first-class forest country, through red volcanic loams originally carrying softwood scrubs, to the dark-brown clays of brigalow scrub areas. While light sandy soils and heavy clay soils are not as suitable as the

Plate 1.
Stool of Rhodes Grass in Flower.

loams, it offers promise of giving useful pasturage on heavy soils. When protected from burning, there is evidence that it will minimise the extensive cracking which is a feature of this soil type.

Planting.

Rhodes grass should be sown during the spring or summer. In the southern part of Queensland where early frosts are not uncommon, planting is best carried out in the spring or early summer, provided adequate rains are received to ensure germination and establishment of the seedlings. On the coast, and in central and northern Queensland, the safest planting time is during the summer wet season.

In the Callide Valley, plantings carried out as late as May have been successful, as the seedlings survived the winter to make rapid growth in the following spring. In districts where very high summer temperatures are experienced, it is not uncommon for seedlings resulting from a planting made after an isolated storm to be burnt off in the ensuing heatwave.

Broadcasting by hand on foot or on horseback is the usual method of distributing the seed, especially in new scrub burns, where the ash forms a satisfactory seedbed.

It can also be sown successfully through standard wheat drills, using sieved sawdust or rice hulls as diluents. If required the seed may be mixed with fertilizer and sown through the fertilizer box of a seed drill or through a fertilizer spreader. The diluent and seed should be well mixed to ensure an even distribution of the seed.

Plate 2.

Rhodes Grass Pastures, Degilbo, Central Burnett.

Rhodes grass seed is variable in quality, due mainly to faulty harvesting and the fact that the seed crop does not ripen uniformly. The minimum germination prescribed under the Agricultural Standards Act is 30%.

When broadcasting, a rate of 7–8 lb. per acre is recommended, but where a wheat drill is being used this rate can be greatly reduced. In the drier areas, when wheat drills are used, 2–3 lb. per acre should be sown in rows 21 in. apart.

In the higher rainfall areas, Rhodes grass is sometimes planted in a mixture with paspalum and green panic, and because of its rapid early cover acts as a check to weeds whilst the slower growing main grass is becoming established. Under these conditions, Rhodes grass is usually short-lived, and after the second season following the gradual depletion of the stand, the main pasture becomes established.

In some districts, the grass is broadcast in maize or sorghum rows at the time of the last cultivation in late summer or early autumn. The standing crop affords the grass seedlings protection from frost and a satisfactory pasture is obtained. Large areas of Rhodes grass have been established in the Burnett districts and in the Callide and Dawson Valleys by sowing the seed in late summer among cotton crops which were planted as cash crops immediately following scrub burns.

Sudan grass, white panicum and other summer fodder crops are sometimes used as cover crops, particularly when early summer or midsummer plantings are attempted.

In some coastal and near-coastal districts where seed-harvesting ants may remove a lot of seed following summer plantings, winter sowing is practised, a light sowing of oats or wheat being used as a cover crop to give protection against frosts. Under these conditions, grass seedlings remain dormant until the following summer, when they make rapid growth.

Plate 3.

A 12-Year-Old Stand of Rhodes Grass on an Alluvial Flat on East Funnell Creek, Sarina.

Rhodes grass has also been established in grazing country by drilling the seed direct into grazed-out or burnt-over native pastures. Sometimes tine cultivation following broadcasting has also proved to be beneficial. Growth under these conditions will be less satisfactory than it is on cultivated land, unless soil fertility is high and competition from the native pastures is not severe. Where legumes can be included the results are more satisfactory.

Contour furrows in forest pastures provide a good seed-bed for the establishment of this grass in association with lucerne or phasey bean (*Phaseolus lathyroides*).

Lucerne seed at 1 lb. per acre can be sown with Rhodes grass, except in the lower rainfall areas, when ½ lb. per acre should be mixed with the 2–3 lb. Rhodes grass planted through wheat drills on shallow soils. Work by officers of the C.S.I.R.O. has also shown that on self-mulching black soils lucerne may be established by broadcasting in the autumn over burnt Rhodes grass pasture, aided by light cultivation. This method of establishing lucerne is well worth trial in the old Rhodes grass stands on the lands originally under brigalow and softwood. Superphosphate applications may be necessary if the soil is deficient in phosphorus. Where possible, heavy stocking for a short period should be used in preference to burning for the purpose of removing the mature growth.

Another legume which has shown promise in combination with Rhodes grass is phasey bean. Seed of this prolific, self-regenerating legume is not readily available commercially, but seed can be collected by hand from natural stands in many localities. It should be sown at 1–2 lb. per acre. Phasey bean is susceptible to bean fly attack, but in areas where this pest is not troublesome, a planting rate of 1 lb. of seed per acre is satisfactory.

Preliminary work on the heavy dark-brown clay soils of the 25–30 in. rainfall belt in southern Queensland has shown that on cultivated land sown

Plate 4.

A Good Pasture Mixture of Rhodes Grass and Burr Medic at Inglewood.

with Rhodes grass, the legume burr medic will grow prolifically with the Rhodes grass, at least in the early years of the stand. The resultant mixture forms a palatable and very nutritious pasture.

All legume seed should be inoculated before planting to provide the best conditions for establishment. The inoculum is obtainable free of charge on application to the Department of Agriculture and Stock, William Street, Brisbane.

Management.

The pasture areas should be suitably subdivided to enable short intermittent grazings of each paddock, and the grazing should be so controlled that each paddock is eaten off when the growth is young and leafy. Hard grazing, particularly on light soils, must be avoided. The scattering of manure lying on the pasture should be regularly carried out wherever a suitable implement can be worked.

Sound management of newly established pastures is particularly important. Although Rhodes grass seedlings will make rapid growth under favourable soil and weather conditions, the stand should be allowed to flower and seed prior to grazing or mowing for hay. Premature grazing can spoil the pasture.

Plate 5.

Sown Pasture of Rhodes Grass and Lucerne on Right; Unimproved Blady Grass and Bracken on Left; Peachester.

Native legumes, including species of *Rhynchosia, Glycine* and *Vigna,* are commonly found in established Rhodes grass areas. These perennial legumes have a twining habit and make their best growth in the summer. The young growth is somewhat unpalatable to stock, a feature which favours seed production of the plants, but the mature growth is relished by grazing animals. In the aggregate, however, these legumes do not provide a thick enough stand to provide a good grass/legume pasture.

When well established, the stand can be stocked at the rate of one beast to 3–5 acres. Severe damage, however, can be caused by overstocking, due to the pulling out of the grass runners, especially on shallow soils. Serious damage is most likely to occur in drought. Thinning of the stand due to overstocking usually results in a

widespread invasion of weeds into the pasture. Soil erosion may be pronounced also on scrub slopes denuded of adequate cover by overstocking.

Improvement of deteriorated Rhodes grass pastures can be obtained by spelling for a season, so that seeding will enable thickening of the stand. Renovation with implements such as the "bush and bog" or cutaway disc harrows is often useful. Such renovation should be carried out during the summer growing season. Another form of renovation involves the mowing and light discing of plant residues after the season's grazing is complete. This reduces the danger of grass fires and helps to incorporate the mature foliage and straw in the soil. Renovated pastures should be stocked with caution to ensure that the cover of new growth becomes well established.

Experience has shown that Rhodes grass stands established without legumes on forest soils seldom maintain maximum production for more than three years and then commence to decline because of nitrogen deficiency. Overgrazed paddocks may become so weed-infested that ordinary renovation may not be worthwhile. In these cases where soil conditions and the nature of the country are suitable, the best practice is to adopt a crop/grass rotation. This system is of benefit not only to the Rhodes grass pasture but also to the crops included in the rotation, because of the improvement in soil conditions.

Cotton and peanuts can both be profitably rotated with Rhodes grass. Good growth and production can be maintained for three to five years, depending on circumstances, before the pasture is ploughed up. In tobacco areas the inclusion of Rhodes grass in the crop rotation is recommended. Both yield and leaf quality have been found to improve in the crop following the ploughing out of the Rhodes grass.

In coastal areas or hillside scrublands where legume establishment with Rhodes grass has proved to be difficult, the use of applications of a fertilizer mixture containing nitrogen and phosphorus is worth trial. It is possible also that lime or dolomite may be required to stimulate growth of Rhodes grass and associated legumes. Farmers or graziers interested in the use of fertilizers for Rhodes grass pastures should consult the nearest Adviser in Agriculture. Small trial areas should be treated first so that the economics of treatment can be calculated.

A sound practice is the growing of crops for grazing and ploughing-in before sowing a stand of Rhodes grass. Usually an early crop of cowpeas can be grazed and the land prepared in time for a late-summer grass planting. On the other hand, an autumn sowing of a cereal and field peas (or vetches) will give valuable winter grazing and permit a summer planting of the grass.

In brigalow scrub areas, regrowth of brigalow suckers often proves troublesome in Rhodes grass pastures. Controlled burning will assist to reduce the population of suckers, but caution must be exercised. The pastures must be carefully managed to avoid the harmful effects of overstocking. If the stand of grass becomes too thin or if sufficient mature pasture growth is not allowed to develop, a good burn is not possible, and brigalow regrowth soon becomes a menace. The development of a reliable economical method for controlling brigalow would be of incalculable value in grassing down a large belt of this type of country in Queensland. Investigations for this purpose are at present in progress.

Fodder Conservation.

Rhodes grass pastures provide a very useful source of hay. Their potentialities in this direction have been explored very little in Queensland and large areas carrying heavy growth are permitted to mature and be wastefully burnt each year.

Based on protein content, the younger growth of Rhodes will produce the highest quality of hay, but from an economic viewpoint, cutting for hay is best delayed until a maximum amount of hay with moderate protein content can be obtained. This stage is usually reached as the plants commence to flower but have not set mature seed. Many Rhodes grass stands with three months' growth following spring and summer rains will produce hay with 7% protein. With a satisfactory proportion of leaf to stalk, a palatable, nutritive hay can be obtained. Quality and palatability of the hay will vary with the conditions under which it is made, but in general all classes of stock will eat it without excessive waste.

The yield of hay is also variable. On fertile soils in an average good season, up to two tons of hay per acre may be cut from prolific stands. Good regrowth which provides useful winter grazing will follow mowing if growing conditions are favourable. Where heavy frosts are experienced, the upper part of the grass is frosted but the sheltered basal portion will provide grazing material.

Rhodes grass pastures can be used for silage making. Yields of four to six tons of green material per acre can be obtained from vigorous stands. The younger green growth with high moisture content is best suited for silage purposes. With this type of growth, efficient clamping, packing and sealing can be carried out. If left to go to seed, growth of Rhodes grass becomes too dry and stalky and is unsuitable for good silage.

Feeding Value of Rhodes Grass.

As a rule, provided it is cut or grazed before it matures, Rhodes grass is of moderate to high palatability, though in the coastal districts and on certain soil types in the drier areas, the plant is often neglected by stock if alternative grazing is available. This unpalatability is most conspicuous on the coast when the grass has made rank growth. Nevertheless, during the 1951 drought, stands of Rhodes grass in the Brisbane area were observed to provide useful fodder at a time when pasture reserves were very low.

Its recovery after grazing or cutting is good, particularly in young stands, provided that the weather conditions are favourable. The feeding value of the leafy material of Rhodes grass pastures grown under favourable conditions is excellent, the grass being rich in proteins and other nutrients.

Plate 6.

A Good Cover of Rhodes Grass on a Pondage Bank.

As with other grasses, the protein level drops markedly as the plant matures. This change in chemical composition is shown in Table 1, in which Rhodes grass is compared with buffel grass, Queensland blue grass and Guinea grass.

Investigations by officers of C.S.I.R.O. have shown that the inclusion of even light stands of lucerne in Rhodes grass has a beneficial effect on the nutritive value of the resulting pasture mixture.

Of the methods now in use, the highest quality seed combined with highest yields is obtained from the reaper and binder technique or from hand harvesting. In the former method, the grass is cut when the majority of the seed heads are mature, and stooked. After drying in the stooks the grass seed is threshed out. An average of 600–700 lb. of seed per working day can be obtained over the whole harvest period by this method.

TABLE 1.

Composition of Various Grasses on Moisture-Free Basis.

Grass.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.	CaO.	P_2O_5.	Remarks.
	%	%	%	%	%	%	%	
Rhodes grass ..	13·7	0·7	42·3	33·9	9·4	·485	·389	Grown on scrub soil; grass 6 weeks old
Rhodes grass ..	7·1	0·9	47·5	34·8	9·7	·409	·229	Grown on scrub soil; grass 3 months old
Rhodes grass ..	4·3	0·8	49·8	35·9	9·2	·358	·337	Grown on forest soil; grass 3 months old
Rhodes grass ..	5·8	1·2	51·7	33·3	8·0	·589	·604	Cut in November six months after previous cut
Rhodes grass ..	14·5	1·6	45·4	28·7	9·8	·545	·260	Cut in November four months after first grazing
Buffel grass ..	18·0	1·6	40·7	27·0	12·7	·953	·670	Young growth
Buffel grass ..	5·6	1·2	52·8	30·4	10·0	·25	·154	Dry stemmy plants
Buffel grass ..	8·3	0·8	43·7	38·5	8·7	·272	·157	Stemmy, Leafy. In full seed head with ripe seed
Queensland blue grass ..	10·0	1·1	42·5	33·1	13·1	·544	·547	Green; in seed
Queensland blue grass ..	3·9	1·0	47·6	36·4	11·1	·396	·334	In seed
Guinea grass ..	6·8	1·0	37·2	26·3	10·9	·54	·59	Mature growth

Seed Production.

The bulk of the Rhodes grass seed sold in Queensland is produced within the State. Of recent years the proportion harvested by machinery has increased greatly, but considerable amounts are still harvested by hand. Machine harvesting is carried out with reapers and binders, header-harvesters or locally improvised equipment.

The header-harvesters also have a high output of seed but the proportion of immature seed is often higher and may result in heating and loss from mould. This method is quicker and involves less labour than the reaper and binder technique, but seed production per acre is less. Special harvesting improvisations range from troughing fixed to the bumper bar of

a truck to cutter blades, threshing drum and screens mounted on suitable trucks. The use of a trough fixed slightly below seedhead height to the front of a vehicle, which is then driven through the crop, results in high-quality seed, as only mature seeds are collected. However, the output of seed per day is relatively low. The problems associated with the harvesting of Rhodes grass seed are being studied on the Regional Experiment Station at Biloela.

Seed yield per acre is dependant upon a number of factors, such as vigour of the stand and weather conditions, but 50–200 lb. seed per acre can be expected from a well-grown stand left for seed harvesting.

Pests and Diseases.

Fortunately, Rhodes grass pastures are not greatly affected by pests and diseases. Outbreaks of white grubs of the genus *Rhopoea* have occurred in the southern parts of the State on basaltic scrub soils. Red spider occasionally causes slight damage, whilst Coccid infestation is of some consequence. Rust is a rare occurrence.

Special Uses.

On account of its running habit and rapid early growth, Rhodes grass is of considerable value in soil conservation work. It is possibly the best species in Queensland for establishing in waterways and for general soil stabilisation purposes in the drier agricultural areas of the State. Its worth in this regard has been shown over a wide area from the Darling Downs to North Queensland. In the wetter districts, however, it is inferior to such grasses as paspalum, kikuyu, and blue couch for soil erosion control.

VOL. III. OF THE "QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK."

"INSECT PESTS AND DISEASES OF PLANTS."

This recently issued handbook contains a wealth of information on pests and diseases affecting cultivated plants in Queensland. It contains 560 pages and over 300 illustrations.

Obtain your copy now from the Department of Agriculture and Stock, Brisbane.

Special Price to Queensland Producers—10s.—Post Free (Others £1, Post Free).

Preparing Passion Fruit for the Fresh Fruit Market.

C. G. WILLIAMS, Supervisor, Preparation and Transport, Horticulture Branch.

With passion fruit, as with all other fruit, good marketing results depend on correct harvesting, handling and packing methods.

The variety of this fruit commonly grown in Queensland is the medium-sized, dark-purple-skinned type. Grown under suitable conditions this variety will yield two crops each year. The main crop period is during the early summer months, and there is a light winter crop during May, June or July.

Harvesting.

Maturity.—For distant markets the skin colour of the fruit should be half to three-quarters purple at the time of harvesting. For the local market the full purple colour is the most satisfactory. Full-coloured fruit that has fallen to the ground may be marketed provided it is sound, and not excessively skin damaged, overmature or shrivelled.

Picking.—The fruit should be picked from the vine leaving approximately half an inch of the stem at its base.

Suitable harvesting containers are :—

(1) Smooth timbered, clean fruit cases such as the bushel or half-bushel dump.

(2) Clean, rust-free metal cans of about one bushel capacity.

Care in Handling.—The skin of the passion fruit is covered with a thin wax film which is very easily broken. Therefore, all harvesting, handling, packing and marketing operations should be performed in a careful manner in order to retain an unbroken wax film.

The Packing Shed.

Immediately after harvesting, the fruit should be taken to the packing shed, which should be situated in a cool location, well ventilated and with good lighting. Within the shed, a suitable packing bench and nailing-down stand should be provided (Plates 1, 2 and 3).

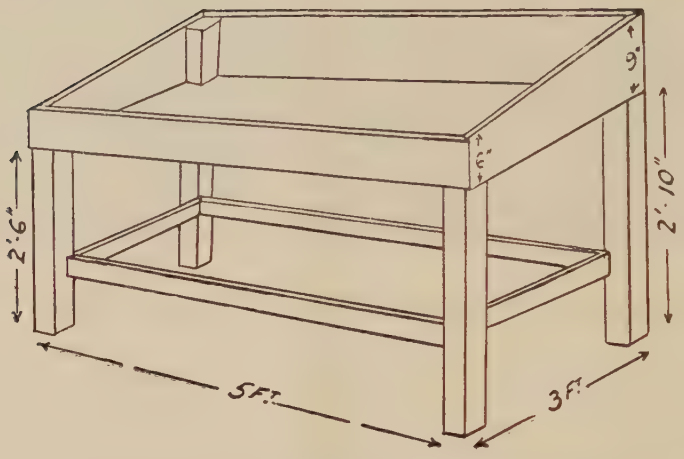


Plate 1.

Bench for Holding Fruit While Packing. Two partitions should be installed within this bench in order to accommodate three grade sizes.

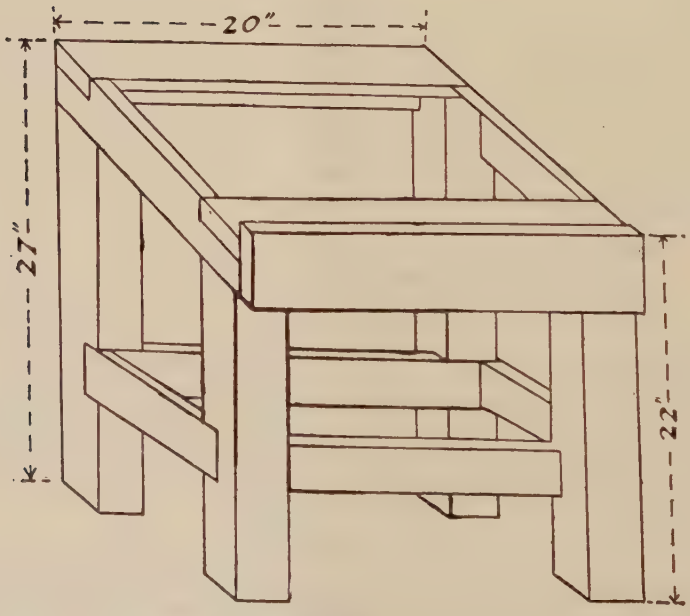


Plate 2.

Packing Stand to Hold Two Cases. Note the tilt on the stand. This helps to hold the fruit in position while packing.

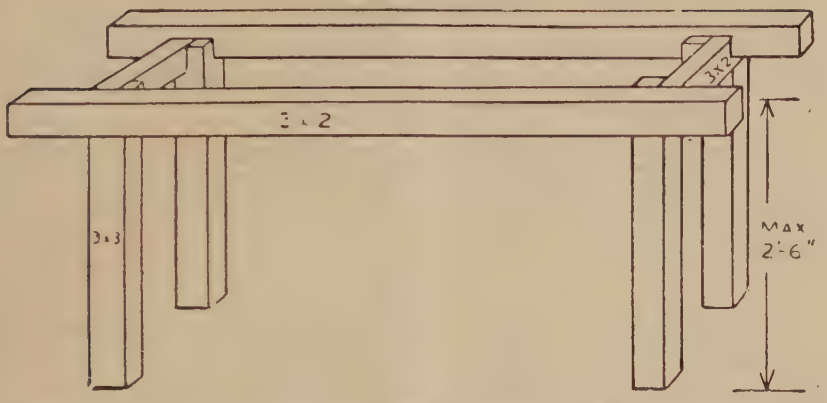


Plate 3.

Nailing-Down Stand Suitable for Fruit Packed in Half-Bushel Cases.

Size Grading.

If a mechanical size grader is not available, the passion fruit should be removed by hand from the harvesting container and placed on the packing bench into three size divisions—large, medium and small. At this stage, all deformed, shrivelled, diseased, undersized or defective fruits should be removed and placed in a separate reject container.

All blossom debris at the base of the stalk should also be removed.

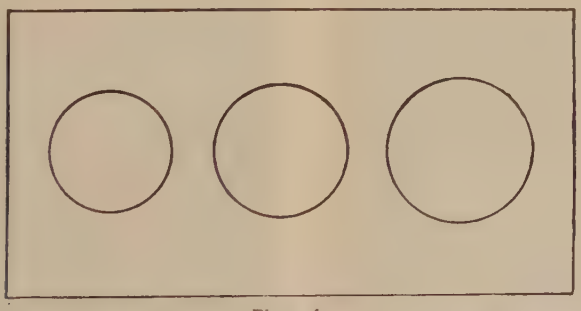


Plate 4.

Hand-Sizing Gauge. The holes can be cut in plywood with an expansion bit or washercutter.

Grade Standard.

The grade standard for passion fruit requires that the fruit shall be sound, well formed, mature but not over-ripe, well filled with pulp, and not less than $1\frac{1}{2}$ inches in diameter. " Well filled with pulp " means that the weight of pulp extracted from the fruit is not less than 45% of the total weight of the fruit.

Pre-cooling.

Fruit harvested during hot weather should be allowed to cool down after grading by holding it in the packing shed overnight.

Market Containers.

Passion fruit is best packed in the dump case or the cardboard carton of half-bushel capacity, both of which are of the internal dimensions 18 in. long, $7\frac{1}{8}$ in. wide and $8\frac{2}{3}$ in. deep.

Woodwool protective padding top and bottom and paper side lining should be used for long-distance transport in the wooden case. As an additional protective measure, this container should be constructed with close fitting boards.

Packing.

The method known as the "diagonal pack" has been found most satisfactory for passion fruit. With this arrangement the pack is built up under a standard system of diagonal and straight lines of even fruit spacing (Plate 7). Provided careful attention is given to even size grading, the fruit packed under this system will fit snugly into spaces (pockets) formed by the underneath layer.

No fruit should sit directly on top of the other but should fit firmly into the pocket. This prevents movement and consequent skin abrasions during transport and at the markets.

Packing Table.

In determining the type of diagonal pack to use for passion fruit of various sizes, the following table will be of considerable assistance to the packer. Diagrams showing how layer counts are made are shown in Plate 5.

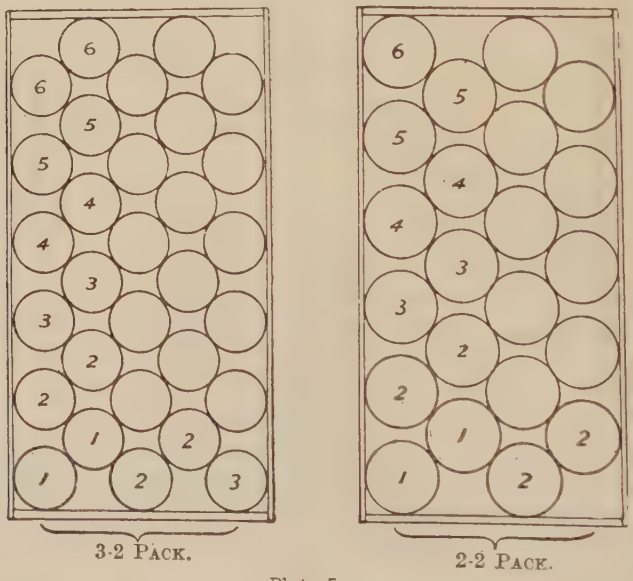


Plate 5.

Diagrams Showing How The Layer Count is Obtained by Counting the Number of Fruit in the First Line and the Second Line of the First Layer. The 3 x 2 pack shown here has a layer count of 6 x 6. The 2 x 2 pack has a layer count of 6 x 5.

Packs and Counts used to bring Passion Fruit to the Correct Height in the Half-Bushel Dump Case or Half-Bushel Dump Cardboard Carton.

Half-Bushel Dump Case. (Narrow Way, 18 inches long x $7\frac{1}{8}$ inches wide x $8\frac{3}{4}$ inches deep).

Pack.	Layer.	No. of Layers.	Total.	Count in dozens.
3—2	9 x 8	6	255	21 doz. and 3
3—2	8 x 8	6	240	20 doz.
3—2	8 x 7	6	225	18 doz. and 9
3—2	7 x 7	6	210	17 doz. and 6
3—2	7 x 6	6	195	16 doz. and 3
3—2	6 x 6	6	180	15 doz.
3—2	6 x 5	6	165	13 doz. and 9
2—2	7 x 7	5	140	11 doz. and 8
2—2	7 x 6	5	130	10 doz. and 10

It may be found that case timber on hand is not of correct specification. When this occurs, the exact layer count as mentioned in the packing table cannot be obtained. It then becomes necessary for the packer to apply the general principles of diagonal packing to conform with the altered case dimensions. This can be done by increasing or decreasing the layer count accordingly.

In half-bushel dump containers made on the $7\frac{1}{8}$ in. width, two types of pack known as the 3 x 2 and 2 x 2 will accommodate the normal commercial range of passion fruit counts.

Bottom Layer.

How to Start the Second Layer.

Plate 6.

The 3 x 2 Pack.

The 3 x 2 Pack.

This arrangement will suit the small to medium-large fruits. As its name implies, this pack consists of a series of 3 and 2 fruits.

To commence the 3 x 2 pack, select 5 passion fruit as near to exact size as possible. Place 2 fruits on their sides in each bottom corner of the case. The third fruit is placed in the same manner in the centre of the case between the two corner fruits. Thus arrayed, with all these fruits forming a straight line across the width of the case (stalks facing inwards), two spaces are formed. Make these two spaces equal in size by moving the centre fruit either to the right or to the left as the case may be. Then place the remaining two fruits in similar fashion into the two spaces and check for correct alignment.

A good firm and neat pack will depend on correct size, grading and alignment. Further progress with the first and subsequent layers is a repetition of the three and two placement with fruit of even size.

In the second and following layers the fruit is placed in the spaces or pockets made by the fruit in the previous layer. The fruit should not sit directly on top of another, but in the pocket. If it sits on top, then grading or arrangement of the fruit must have been faulty.

The 2 x 2 Pack.

This pack will be used for large passion fruit.

To commence the pack, take 4 fruits of equal size. Place one on its side in the left hand corner of the case and the second fruit slightly past the centre in a straight line arrangement across the case. Equalise the two spaces thus formed and then place the remaining two fruits on their sides into these spaces.

The bottom and following layers are simply a repetition of this procedure.

Case Bulge.

The finished pack should extend to approximately $\frac{3}{4}$–1 in. above the top centre of the case and slightly lower at each end.

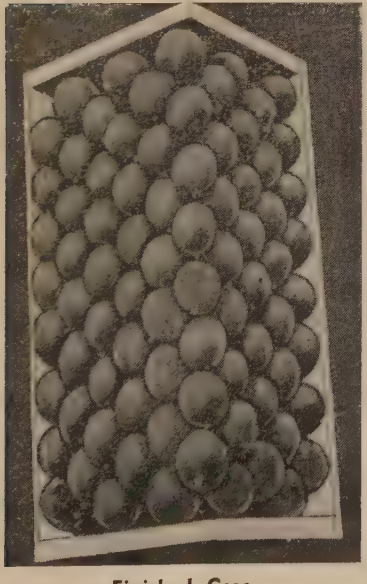
The bulge allows for shrinkage and settling of the fruit in the pockets.

If the fruit comes too low in the case it will work loose in transit, resulting in damage to the fruit.

If difficulty is experienced in obtaining correct height of the pack, this can be adjusted by increasing or decreasing the layer count or by slightly varying the grade size of the fruit throughout each layer.

Bottom Layer.

How to Start the Second Layer.



Finished Case.

Plate 7.

The 2 x 2 Pack. Note the straight and diagonal line arrangement.

Nailing Down.

In nailing down the lid the case should be stood on a nailing-down bench or on suitably sized battens (Plates 3 and 8).

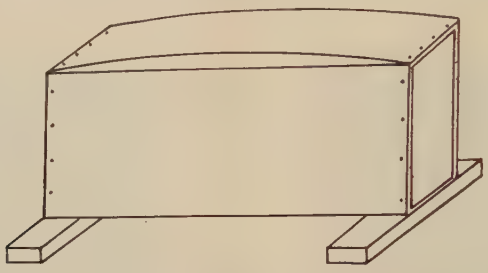


Plate 8.

Nailing Down. Showing method of using two pieces of timber to avoid damage to fruit while nailing down.

After placing the woodwool padding and then the paper lining over the top of the fruit, place the top boards over the pack. Hold the boards firmly in position at each end of the case, then gently dump the case in a rocking motion about four times alternately onto each side of the bench or battens. This dumping motion will firm the fruit into position and equalize the bulge at the top and bottom of the case. With the case still on the bench or battens, nail down the lid.

Transit Condition.

The packed container must always be stacked on its side, and not on the bulged lid or bottom. Cases carelessly stacked are easily damaged during transit. The packed cases should be kept as cool as possible, otherwise excessive shrivelling will occur.

Approved Strawberry Runners.

Following a series of inspections carried out by officers of the Department of Agriculture and Stock, the crops of the growers listed below have been found to conform to the standards prescribed under the approved strawberry planting material scheme.

These growers may now sell their runners as "Approved by the Department of Agriculture and Stock."

Grower.	Variety.
D. J. Brown, "Berryvilla," Cleveland	Phenomenal
A. Fels, Underwood road, Eight-mile Plains ..	Phenomenal
E. H. Lambley, Badgen road, Birkdale	Phenomenal
D. Peter, Marlborough road, Wellington Point ..	Phenomenal
A. J. Wicks, Logan road, Upper Mount Gravatt ..	Phenomenal
J. A. Armstrong, Palmwoods	Phenomenal
L. C. and E. G. Blee, Palmwoods	Phenomenal
A. M. and T. B. Ishoy, Mount Ninderry, Yandina	Phenomenal
D. Lacey, Palmwoods	Phenomenal
W. Muller, Woombye	Phenomenal
J. J. O'Mara, Eudlo	Phenomenal
Miss F. Spackman, Palmwoods	Phenomenal
W. J. and E. Stone, Yandina	Phenomenal

Agricultural Chemistry

Vitamin A and Livestock.

R. GARTNER, Chemical Laboratory.

Vitamin A is of great importance in animal husbandry for it is required by all classes of livestock. Unless care is taken to provide livestock with sufficient of this vitamin, unsatisfactory production will result.

Vitamin A is a fat-soluble substance. It does not occur in the plant kingdom as the true vitamin, but as carotinoids, a group of reddish-yellow pigments, some of which (carotene, &c.) are convertible to vitamin A by animals. Sometimes they are called "pro-vitamin A" or "vitamin A precursors." Thus, while there is actually no true vitamin A in plants, we speak of their convertible carotinoids in terms such as "vitamin A content" or simply "carotene."

The richest sources of carotene for stock are green, leafy forage plants, properly cured legume hays (or meal made from them), young dried cereals, grasses, grass or legume-grass silage. Maize is the only grain with a fair "pro-vitamin" content, and of the tubers, carrots, yellow sweet potatoes and mangolds are the best.

The animal body is able to change carotene into true vitamin A. The change takes place in the liver and any vitamin A in excess of daily requirements is stored there to be drawn upon when no green feed is available. The richest sources of true vitamin A are fish-liver oils. They are used sometimes in supplementary feeding.

The carotene content of pastures and conserved fodder varies considerably. The stage of growth, fertility of the soil, climate, method of preservation, length of storage, and temperature affect the carotene content. The best practical guide to the carotene content of pastures, apart from the chemical analysis, is the degree of green colour. Actively growing pastures are much better sources of carotene than matured or weathered stands.

Cattle.

Calves are born with low reserves of vitamin A and for the first few days after birth are dependent on that in the colostrum. This is variable, depending on the vitamin A status of the cow at calving. In the young calf, symptoms of the deficiency usually begin with "watery eyes," cold in the head with a nasal discharge, and scours—mild to begin with, but quite severe if they continue. As the deficiency progresses, the coat becomes rough, appetite is poor, growth is slow and there is loss in weight. Grossly deficient cows often fail to take their pregnancy to full term. Premature birth of dead or weak calves results. The first easily detected serious symptom of vitamin A deficiency is night blindness, readily observed when cattle are driven in dim light, for their inability to distinguish objects makes them blunder into fences, stumps, &c.

The chief cause of avitaminosis A (deficiency of vitamin A) in cattle is an inadequate intake over a period long enough to permit exhaustion of the liver stores rather than inability to synthesise vitamin A. The time required for depletion is determined by the body reserves of vitamin A, which are affected by the age of the animals and the vitamin A content of the pasture. A deficiency has been produced experimentally in calves by

keeping them on a vitamin A deficient feed for two months, whereas it took six months to produce the same effects in yearling steers. Thus in Queensland, cattle on dry native pastures may become depleted in their vitamin A reserves but deficiency symptoms may be apparent only in the young stock.

Sheep.

Symptoms of vitamin A deficiency in sheep are rare in Queensland. Prolonged grazing on dry pasture is necessary, as sheep are efficient storers and economical users of vitamin A. It has been shown that it takes about two years on a diet low in vitamin A for deficiency symptoms to occur in aged ewes.

It appears probable that an early result of vitamin A depletion is an effect on reproduction. It has been noticed that rams on dry feed in hot weather show reduced fertility. It has also been postulated that sheep are more predisposed to urinary calculi when their reserves of vitamin A are low. Experimental evidence on this point is as yet inconclusive.

Horses.

Horses on good pasture consume many times the amount of carotene necessary for their daily requirements. On feed poor in vitamin A, no ill effects may be apparent for a considerable time provided the animals have built up an adequate reserve of the vitamin. Nevertheless, it is sound practice to provide horses with some feeds that will supply at least the minimum vitamin A requirements, and greater amounts should be provided for mares in foal.

A deficiency of vitamin A is characterised by night blindness, cracked hoofs, swollen coronets and a distinct so-called sweat mark in the region of the last rib. These symptoms have been observed in wild horses in western Queensland.

Pigs.

In pigs, vitamin A deficiency results in slow growth, poor appetite, muscular inco-ordination, staggering gait and impaired reproduction. Susceptibility to infection is increased. Pneumonia is frequent. Weak, malformed and blind pigs have been farrowed by sows receiving inadequate amounts of vitamin A.

The principal sources of vitamin A in pig feeding are fresh green food artificially dried grass, lucerne meal, maize and fresh vegetables. When these sources are not available, the best supplementary source is fish-liver oil.

In-pig sows, sows with litters and breeding boars need considerably more vitamin A or precursors in their diet than growing or fattening pigs.

Poultry.

Poultry require vitamin A at all stages of life, the need becoming greater as maturity progresses. High producing breeding stock require much more than hens kept for commercial egg production. Not only do they require more for high egg production and good hatchability, but they must have an extra allowance for a "carry over" through the egg yolk into the body of the chick at hatching time.

Symptoms of vitamin A deficiency do not usually appear in chicks before the third or fourth week. Growth is fairly normal to this stage, then slows, and symptoms such as drowsiness, weakness and staggering gait are noted. Some chickens develop nutritional roup. These conditions continue for a short time and the chickens eventually die.

It has been shown that vitamin A is an important factor in the resistance of poultry to small intestinal parasites and to colds.

The richest sources of vitamin A most commonly used in poultry rations are fish-liver oils and leafy green crops. Due to the unstable nature of vitamin A it is possible that the required amount of vitamin A is not present in poultry feed at the time of consumption even though it may have been present at the time of mixing. This would favour the development of a borderline deficiency of vitamin A. So concentrated supplements should be mixed into the rations at intervals.

The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 44 of the January issue.*)

Swamp Mahogany.

Botanical Name.—*Tristania suaveolens* (Gaertn.) Sm.

Other Common Names.—Swamp turpentine, swamp box.

Distinguishing Features.—A tree with brown or grey flaky bark, leaves like those of scrub box but less clustered, and flowers and seed-capsules like those of the scrub box but smaller (Plates 68-70).

Plate 68.

Swamp Mahogany (Tristania suaveolens). Leaves and seed-capsules.

Description.—This is a tree up to 80 ft. or so, but it often flowers as a shrub of only a few feet. The brown or grey bark is fissured and flaky, and can be pulled away in long strips. The leaves are arranged at a little distance from one another along the twigs, sometimes with a few clustered at the end, paler and usually somewhat hairy underneath ; they taper to the base

but may be blunt or pointed at the tip, mostly about 1½–5 in. long and 2 to nearly 4 times as long as wide. The flowers are borne in small clusters among the leaves and are less than ½ in. wide when fully out; there are 5 small broad sepals and 5 rounded petals. The stamens are joined into 5 distinct bundles, each bundle with numerous small stalked anthers as in the scrub box. The seed-capsule is smaller and relatively wider than in scrub box.

Distribution.—Chiefly in the coastal districts, usually on swampy ground or alluvial flats but sometimes found as large trees on hillsides. It occurs throughout coastal Queensland and in north-eastern New South Wales.

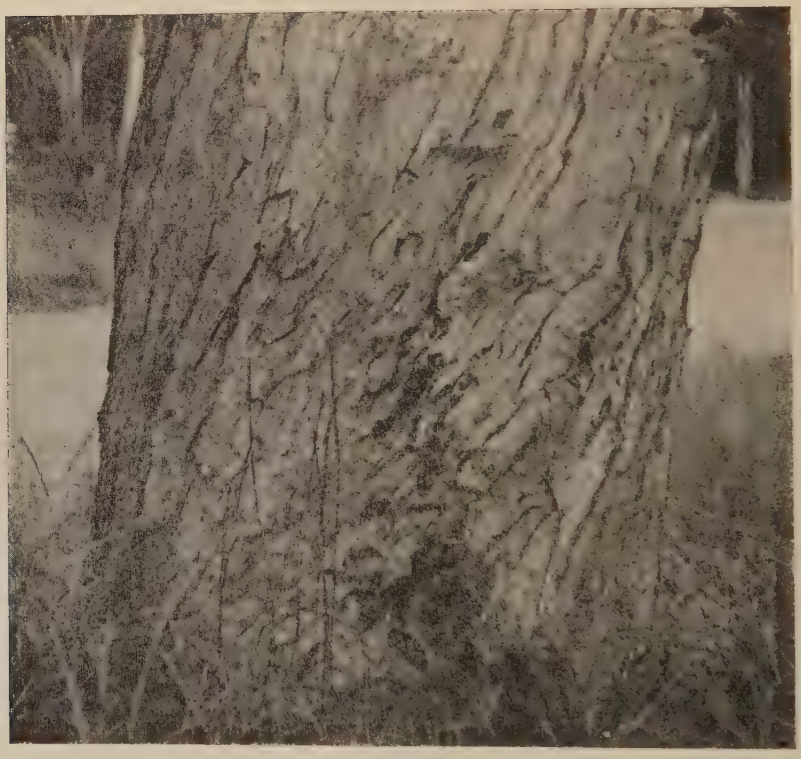


Plate 69.

Swamp Mahogany (Tristania suaveolens). Portion of trunk.

Note.—The name "swamp mahogany" is also used for *Eucalyptus robusta* Sm. and "turpentine" for other trees.

Usual Flowering Time.—November to January.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Nil to minor.

Plate 70.

Swamp Mahogany (Tristania suaveolens). Jimboomba.

General Remarks.—The tree normally produces a small amount of nectar each season. Following dry periods associated with early summer bushfires, however, prolific flowering occurs in some locations, resulting in good crops of honey.

This first grade honey has a good flavour and fair density, and candies readily with a coarse whitish grain. Due to the light colour and flavour the honey is most suitable for blending with lower grades.

Swamp mahogany does not appear to be important as a pollen-producing tree.

[TO BE CONTINUED.]

Brucellosis Testing of Swine.

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

TESTED HERDS (As at 15th January, 1954).

Berkshire.

J. J. Bailey, "Lucydale" Stud, East Greenmount
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
R. G. Koplick, "Melan Terez" Stud, Rochedale
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
E. Pukallus, "Plainby" Stud, Crow's Nest
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, Underwood Road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, "Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Bardell," Goovigen
R. E. Paulsen, "Crest" Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, "Felbar" Stud, Kalbar
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. J. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert

Large White.

H. J. Franks and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. G. Koplick "Melan Terez" Stud, Rochedale
R. Postle, "Yarralla" Stud, Pittsworth
M. K. Collins, Underwood Road, Eight Mile Plains
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
H. L. Larsen, "Oakway," Kingaroy
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
Mrs. I. G. Utting, "White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai" Stud, Clifton
F. K. Wright, Narangba, N. C. Line

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub *via* Beenleigh
R. G. Koplick, "Melan Terez" Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
D. Kay and P. Hunting, "Kazan" Stud, Goodna
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
A. Curd, "Kilrock" Stud, Box 35, Jandowae
F. K. Wright, Narangba, N. C. Line
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
A. H. Groves, "Kinvara" Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea" Stud, Murgon

Still More Wool!

Part I. Introductory.

A. W. BEATTIE, G. R. MOULE and R. E. CHAPMAN, Sheep and Wool Branch.

As Australians we are justifiably proud of our sheep and the men who breed them. In the year ending 30th June, 1953, we reached an all-time record production of almost 1,300 million pounds of greasy wool.

Australia, with one-sixth of the world's sheep, produces one-quarter of the world's total greasy wool and one-third of the world's apparel wool. This position has been achieved by the rapid settlement and development of vast areas of inland Australia. Other new countries of the southern hemisphere have also greatly increased their wool production, while there has been a slight decline in the older, more intensively developed countries of the northern hemisphere.

In 1840, there were about 90 million sheep in Western Europe and the United States of America and only 5 million in the southern hemisphere countries of Australia, New Zealand and South Africa. By the beginning of this century, the European and United States figures had fallen to about 70 million, and the southern hemisphere total had risen to 240 million. In Europe, sheep were occupying as much of the land as was ever likely to be theirs. In the United States, urbanisation, high costs of production and the diversion of pastoral land to crop production were restraining the further growth of the sheep industry.

These factors were far less important in Australia, and the rapid spreading of sheep over the inland grazing areas was almost completed by the end of last century. Since 1891 the long-term average number of sheep has not varied much at all, but climatic, economic and other influences have brought about violent year-to-year fluctuations. The most extreme example of this occurred about half a century ago, when sheep numbers rose from 54 million in 1879 to 106 million in 1891 and fell back to 54 million in 1902.

Queensland figures have generally followed fairly closely the overall Commonwealth trend, but the droughts between 1942 and 1952 have resulted in this State's having rather less than its normal proportion of Australia's sheep. The changes in Queensland sheep numbers from 1860 to 1950 are shown in Fig. 1.

Composition of Flocks.

Australia's importance in the world wool trade rests not only on the number, but also on the kind of sheep run. Table 1 shows the numbers of

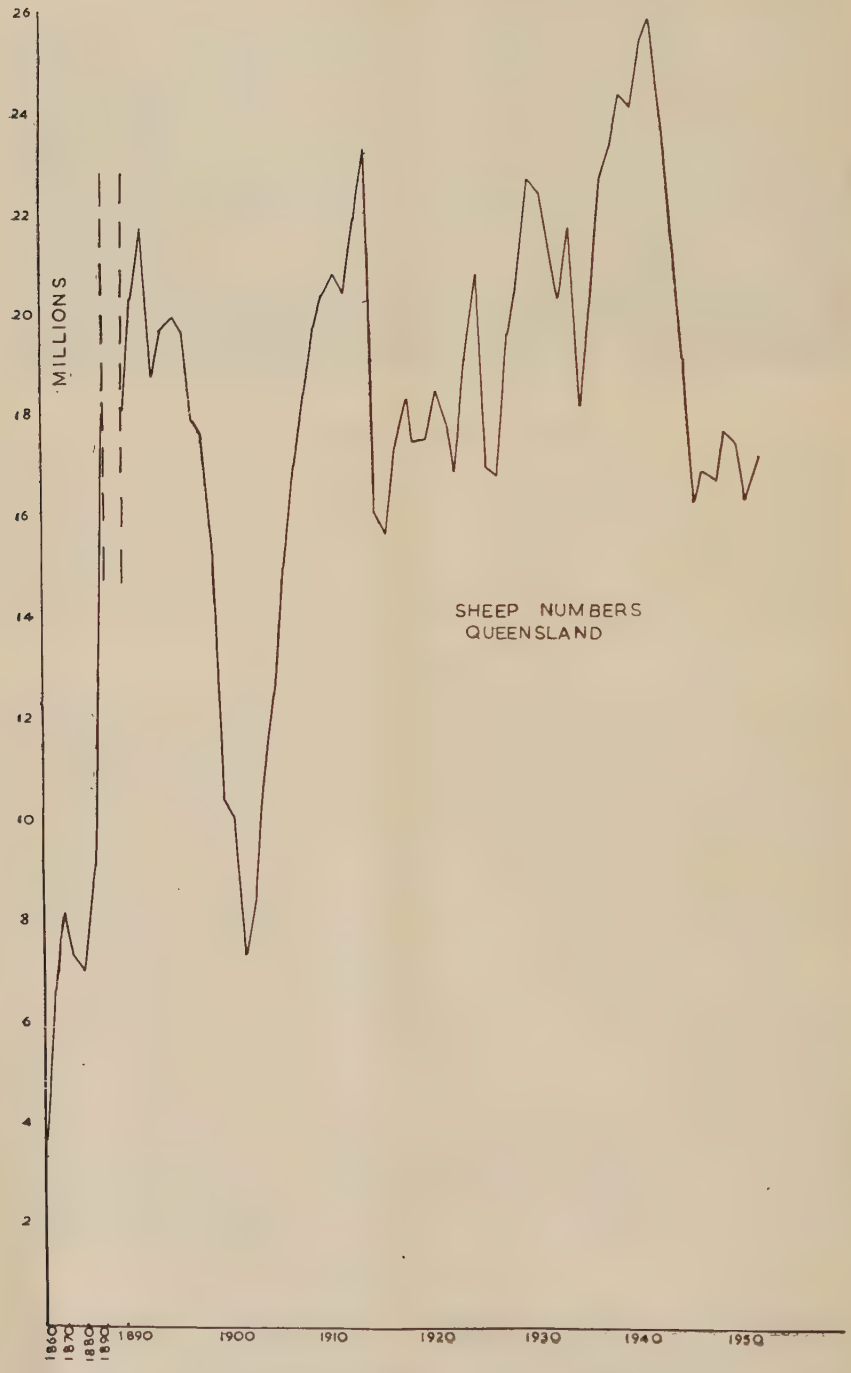


Fig. 1.

Graph Showing Sheep Numbers in Queensland from 1860 to 1952.

sheep of the main breeds (as at 31st March, 1950). About 72-73% are pure Merinos and less than 1½% belong to the pure British breeds. The proportion of pure Merinos used to be higher, but there has been an increasing trend towards the British breeds and their crossbreds in the southern States.

problem, quite apart from any question of increases, is how they are to be stabilised at present levels. Human populations present a different picture.

In 1913, there were 1,800 million people in the world. In 1945, after two world wars, there were over 2,200 million. That is an increase of over

TABLE 1.

Composition of Australian and Queensland Flocks on a Breed Basis (31–3–50).

Breed.	Australia.		Queensland.	
	,000 sheep.	Percentage.	,000 sheep.	Percentage.
Merino	82,134	72·7	17,326	98·6
Comeback	6,218	5·6	55	0·3
Polworth	1,362	1·2	5	..
Crossbred	14,561	12·9	130	0·7
Corriedale	7,125	6·3	54	0·3
British Breeds	1,491	1·3	12	0·1
Total	112,891	100·0	17,582	100·0

In Queensland the Merino has lost little ground and still makes up 99% of the sheep population. This situation should not change much in the immediate future.

Human Populations.

Sheep numbers in Australia and the rest of the world are not making any spectacular progress. One major

20%, and yet sheep numbers have hardly increased since 1890. There was no oversupply of woollen goods in 1913 and there is no shortage of wool in the world yet. The sheep industry has met increased demand by increasing the production from each sheep. This achievement is one of which Australians, in particular, can be proud.

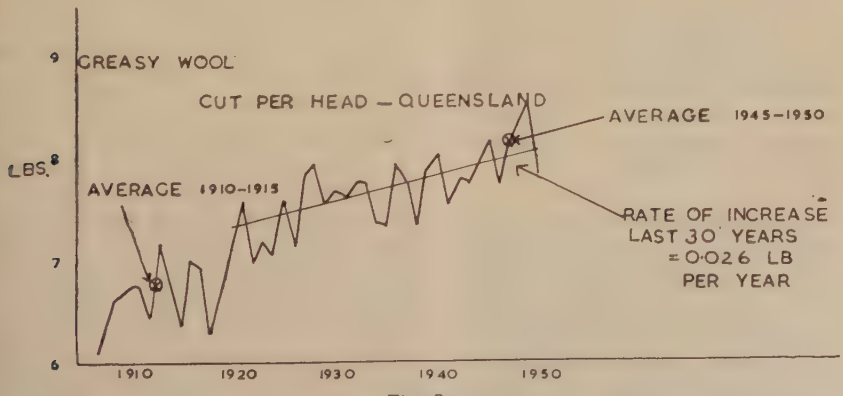


Fig. 2.

Graph Showing Average Cut of Greasy Wool Per Head in Queensland.

In Queensland over the 5-year period 1910-1915 the average cut per head was 6.77 lb. greasy wool (see Fig. 2). In 1945-1950 it was 8.15 lb., an increase of 20%—just enough for us to make up our fair share of clothing the world's extra 400 million people. Just enough, provided world consumption of wool per head had remained reasonably constant. But cut per head in Queensland is not so completely satisfactory after all.

The next graph (Fig. 4) shows production of the three main fibres, cotton, wool and rayon, as percentages of total fibre production each year. In the case of wool, there may be some very slight evidence of a downward trend. Generally, however, the impression must be of remarkable

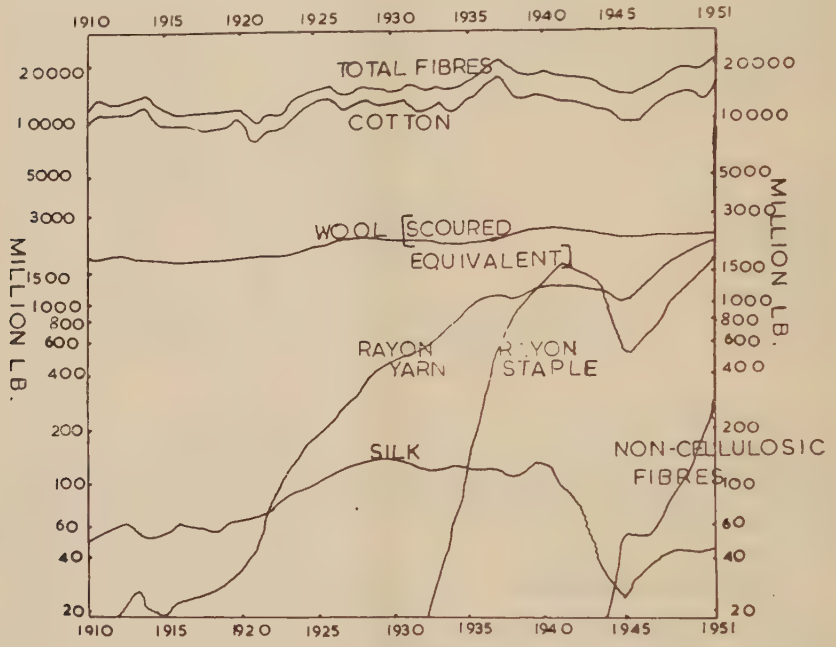


Fig. 3.

Graph Showing World Production of Clothing Fibres. This graph is taken from "Wool Outlook." It is drawn with a logarithmic vertical scale and care must be taken that the actual graduations are kept in mind rather than the slopes of the various curves.

the human population has been increasing even faster since 1945 and textile requirements per head are not remaining constant. They are increasing each year.

Other Fibres.

Fig. 3 shows world production of the six main clothing fibres. Over the period 1910-1915, the average yearly production of clothing fibres was 12,300 million pounds. By 1945-1950, production had risen to 16,300 million pounds, an increase of over 30%. This means that the 20% increase in stability. In fact, in the 5-year periods 1910-1915 and 1945-1950, the average percentage is the same—14⅓%.

One point which is brought out by all these graphs is the great difficulty in choosing typical 5-year periods for comparison. It is easy to see what each one indicates, but hard to go from one to another. For this reason, yet another graph (Fig. 5) has been constructed to show the contribution made by Queensland wool to world wool production each year. From this we see that Queensland producers have been keeping up their share of world production very well.

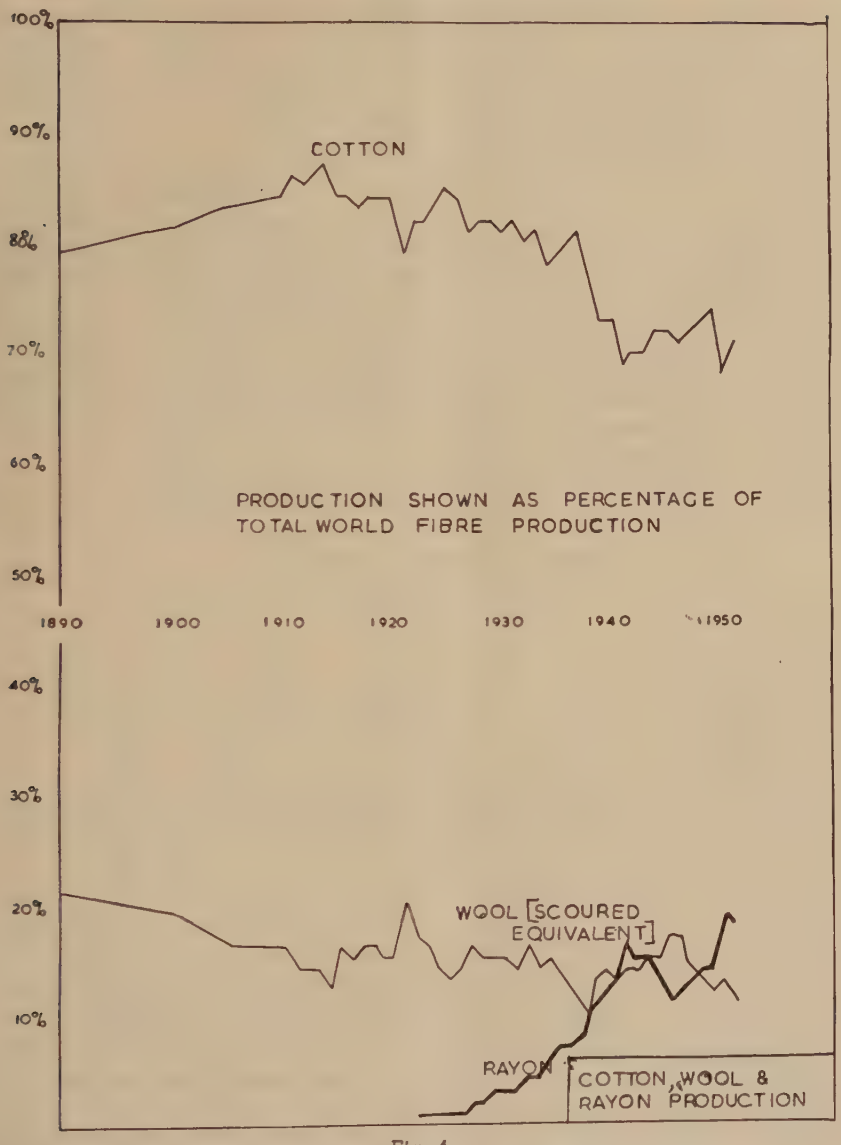


Fig. 4.

Graph Showing World Production of Cotton, Wool and Rayon.

The fundamental fact that wool production depends primarily on sheep numbers is shown by the close similarity of Figs. 1 (sheep numbers) and 5 (share of world production).

Wool and Other Fibres.

Reverting to Figs. 3 and 4, it is seen that cotton continues to maintain its leading position. Production is being kept up reasonably well after a 10-year slump from about 1937 to 1947, but cotton is now making a smaller contribution to world fibres. This decline is being almost exactly compensated by the increasing production of rayon, even though it now enjoys a smaller price advantage than formerly.

The newer non-cellulosic synthetics, such as nylon, terylene and orlon, came into prominence as the Pacific war curtailed silk production. Since 1946, the combined output of these fibres has exceeded that of silk, and their production continues to increase rapidly.

Over the last few years, wool has been replaced in some of its uses, but the peculiar properties of the wool fibre seem certain to retain its position securely. Provided wool production is kept up and its price remains on a competitive level, there is no reason why consumption should not even be increased. In some cases, a wool-synthetic blend has advantages over fabrics made from either individual fibre. If this means an extension of the use of wool, it should be welcomed. It is not always a matter of wool's being adulterated with synthetics. Apart from this aspect, there is plenty of room for all fibres, natural and man-made, in a world in which the population is increasing by 20 million a year. There is unlimited scope for increased consumption of wool per head as living standards improve. The future for wool is very bright just as long as shortages or excessive prices do not permit and encourage its replacement. If this were to occur, the change could well be permanent, as it appears to be now in the case of cotton and silk.

Maintaining Queensland's Production.

It is clear from all these figures that Queensland's stud masters and graziers have been doing a good job in increasing Queensland's wool production. It is clear, too, that as sheep numbers continue to fluctuate so markedly, this increase has come almost entirely from raising the average cut per head of each sheep.

There are two possible methods of increasing production per acre of pastoral land. The first is to improve the cut per head still further and the second is to raise the effective carrying capacity of the existing sheep lands. The two are related closely: the development and extension of facilities on a property lead to the running of more sheep. In fact, the shape of the graph showing the cut per head indicates that all the improvement has not come from the breeding of better sheep. The sharp jump over the period 1918-1921, for instance, is clearly the result of a

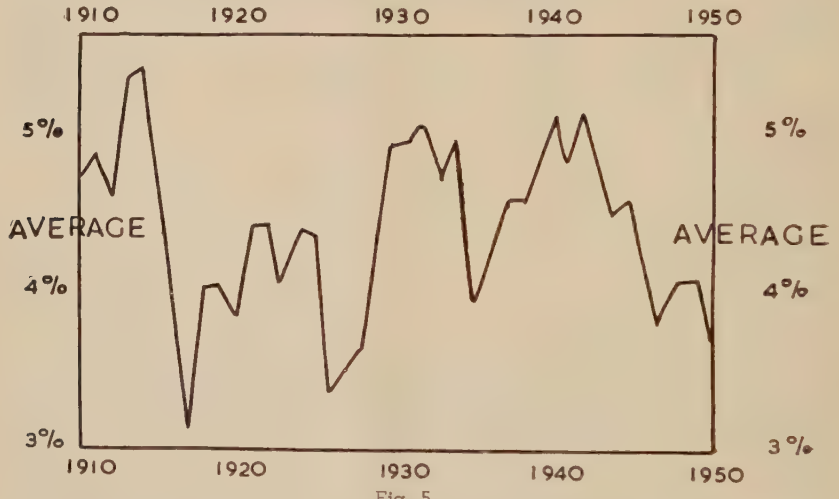


Fig. 5.

Graph Showing Queensland's Contribution to the World's Wool Production.

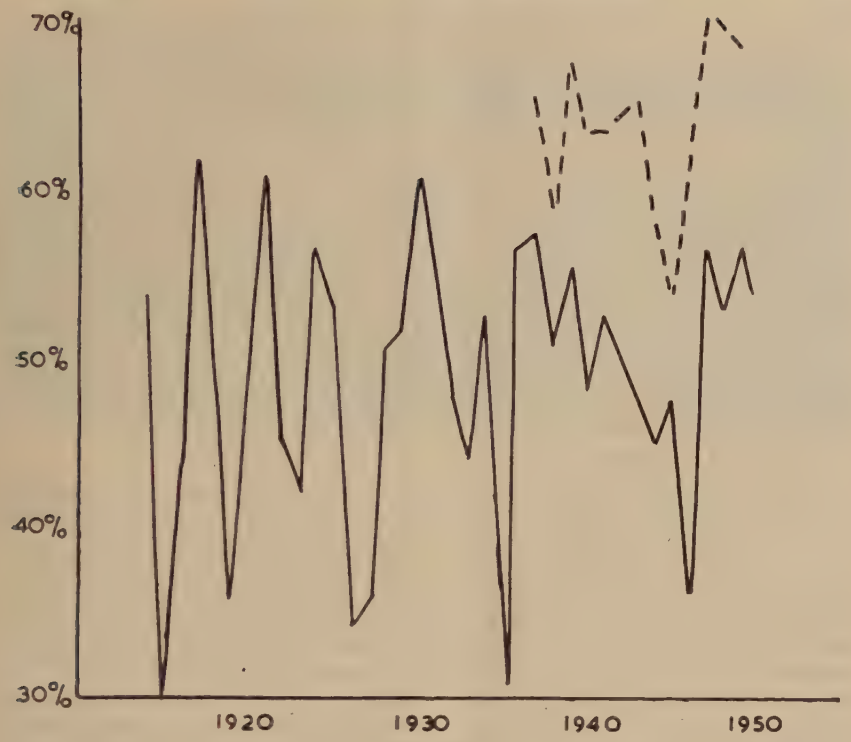


Fig. 6.

Graph Showing the Variation in Queensland's Lamb-Marking Percentages. The lines show lambs marked as a percentage of ewes mated, the unbroken line for Queensland and the dotted line for Australia.

combination of husbandry, seasonal, and land utilisation factors, rather than of any great breeding advance. Since about 1920, there has been a fairly steady rate of increase—about $\frac{1}{40}$lb. per year. Even so, it would be hard to ascribe all of this increase to breeding. Probably half or more of the yearly increase has come from improvements made on sheep properties, more subdivisional fencing, better water facilities, and so on. That leaves about $\frac{1}{80}$th of a pound (or $\frac{1}{5}$th of an ounce) which has come from breeding! This figure can be improved by using better methods of breeding, but just for the moment let us return to the other side of the question.

In the southern States, carrying capacity is being increased by pasture improvement. There is relatively little scope for this in Queensland, where most of the pastoral areas receive less than 20 inches of rain each year. Therefore, the approach in Queensland is rather on minimising the losses which so frequently occur from droughts, floods, and other seasonal causes. Our immediate aim should be to try to bring the average number of sheep in the State closer to the maximum number which can be run with safety, year in and year out.

There is, clearly, always room for some improvement in the management of most properties. Better fencing, more water, more shade, and the application of improved methods of parasite and pest control must lead to a greater effective carrying capacity and also to greater production from each sheep. It is not by any means suggested that the sheep industry is not meeting its responsibilities

efficiently and well, but if wool production is to be raised by the maximum amount each year, every small opportunity for improvement must be taken. Once a new technique has proved its worth, every year in which it is not applied means a loss of wool and revenue.

Drought remains probably the greatest cause of losses in Queensland. There is no easy solution, but the woolgrower of to-day is far better equipped to cope with the situation than in the past. Work on the climatology of Queensland has given woolgrowers information from which the chances of drought can be assessed, even if prediction is not yet possible. The feeding value of all sorts of fodders is known and it is now a simple matter to work out the comparative costs of selling and restocking, allowing sheep to die and restocking, feeding, and agisting. There is scope, too, for minimising the effects of drought by better flock management. It is obviously better to get through a drought by selling wethers and old ewes than to be overstocked with young breeding ewes and have to watch them die. On many properties, some conservation of natural fodder is possible and may prove a very useful reserve.

The other very large source of loss is reflected in Queensland's lamb-marking percentages (Fig. 6). They are consistently lower than those of other milder areas of the Commonwealth.

Research work is in progress on the effects of hot, dry climates on the fertility of rams and their desire to work, on ewe fertility and mothering ability, and on the survival and growth of lambs.

It may well be that increasing attention in sheep breeding will have to be given to the adaptation of the Merino to its surroundings. Some sheep tolerate hot weather better than others, and it may eventually be possible, by selecting rams on their reliability as sires under high temperature conditions, and ewes on their ability to rear fast-growing lambs, to improve the general constitution of Queensland's Merino sheep.

Until these aspects are more fully investigated, much can be done by supplementary feeding where necessary, manual examination of rams for signs of infertility, and the control of predators at lambing.

Increasing the reproduction rate affects wool production in a number of ways. There is a clear financial advantage which should mean more money for further development of a property. Unavoidable drought and other losses can be made up quickly. Most important of all, there is more scope for culling low producers and selecting only the very best animals for breeding.

The breeding of still better sheep is the basic answer to the need for more wool. Improvement in the methods of selection can very easily add, each year, more than one-fifth of an ounce of wool, which has been the average for the last 30 years.

The Cattle Country of the Central Highlands.

J. J. SULLIVAN, Cattle Husbandry Branch.

The Central Highlands region (Plate 1) comprises the shires of Bauhinia, Emerald and Peak Downs and about two-thirds of the Jericho Shire, the aggregate area being about 3,500 square miles. The region lies between lat. 21° 30′ and 24° 30′ S. and long. 146° and 149° E. and is roughly bisected by the Tropic of Capricorn. Its distance from the coast varies from 100 to 300 miles.

The elevation of the area is 1,057 ft. at Springsure and 870 ft. at Clermont.

CLIMATE.

The climate is warm and sub-humid, the annual average relative humidity at 9 a.m. being 60%. The average annual rainfall is approximately 25 in., but the beneficial effects of this rainfall figure are lessened by the high degree of irregularity and unpredictability of the falls from year to year. More than two-thirds of the total rain falls from October to March, sometimes wholly in December-January-February, with the greater portion falling over a period of two to three weeks in any one of these months.

TOPOGRAPHY.

The region slopes towards the north from the Buckland Tableland, which forms part of the Great Dividing Range and is an area of broken country with rugged timbered hills and fertile well-grassed plains. The Drummond Range roughly bisects the region and forms the watershed between the Burdekin River and the Fitzroy River systems. The main streams are the Belyando River (Burdekin system) and the Nogoa and Comet Rivers (Fitzroy system).

Superficially the region would appear to be well watered, but actually there are very few permanent waterholes and for the greater part of the year the watercourses are dry depressions with here and there relatively short stretches of water, which often become deathtraps for stock in drought. Occasionally there is a deep and permanent billabong. From a grazing point of view, the watercourses are of great significance, as they are fringed by the most desirable type of grazing country.

Plate 1.
Sketch Map of the Central Highlands Region.

TYPES OF GRAZING COUNTRY.

In popular terminology, the following are the main types of country represented in the Central Highlands :—

(1) Mountain or Rangy Country.
(2) Ridgy or Hilly Country.
(3) Tableland Country.
(4) Brigalow Scrub.
(5) Gidyea Scrub.
(6) Broken Plain.
(7) Frontage Country.
(8) Blacksoil Downs.
(9) Desert.

1. Mountain or Rangy Country.

Properties composed mostly of rangy country are situated on the main mountain ranges and the high spurs, such as those along the Great Dividing Range, the Carnarvon Range, the Drummond Range and the Expedition Range. Much of this country is extremely rough, with high rocky peaks, cliffs and gorges. A good deal of the area is thickly timbered, and is only third-class grazing, called "hungry" country, on which cattle do not thrive. In some localities on this type of country heavy losses have occurred among cattle through their eating the larvae of the sawfly, which they obtain at the base of silver-leafed ironbark trees. Eucalypts and wattles are the main timbers. Poisonous plants such as zamia and wild peach also grow in this country. The pasture species are mainly spear grass, wire grass, kangaroo grass and spinifex.

2. Ridgy or Hilly Country.

Ridgy or hilly country is found on the outer foothills and the lower and less rugged offshoots of main spurs. This type of country varies a great deal, and the kind of timber growing thereon is an indication of its grazing value. For instance, there are ridges timbered with gum, wattle, ironbark (both broad and narrow-leaf), bloodwood, lancewood, rosewood and bendee, and some relatively bare ridges. Experience is required to assess the value of this country, which may vary from first to third-class grazing. Its carrying capacity may vary from a beast to 25–30 acres to a beast to 80–100 acres. This class of country may have wide, fertile and well-grassed valleys, and narrow creek flats.

The pasture species vary; they include those found in the rangy country, with more palatable and nutritious species of blue grasses in the valleys and along the creek flats. Generally this country is used for breeding of stores, combined in some cases with the fattening of spayed cows.

Plate 2.

Tableland Country of the Central Highlands.

3. Tableland Country.

This is a type of forest country found outlying from mountain ranges and ridgy country, the typical timber species being "Tableland" coolibah, bloodwood, kurrajong and silver-leaf and narrow-leaf ironbark. It is a type of high wooded downs, exhibiting a panorama broken sometimes by ridges, sometimes by undulations and belts of timber. The soil is dark grey to black. Pebbles and gibbers are often seen on the surface. The pasture is composed of desert Mitchell, Flinders and blue grasses. It is first-class fattening country, and has a carrying capacity of a beast to about 25 acres. It is strictly limited in area.

4. Brigalow Scrub.

Brigalow scrub covers a large portion of the Central Highlands. It is found on a variety of soils on both hilly and channel country and has various associated species, all factors of importance from a grazier's point of view. A summary of the types of brigalow scrub is given below.

(*a*) Thick brigalow scrub contains a high population of brigalow trees with a dense undergrowth of varying height made up of young brigalow trees, lavender bush and miscellaneous shrubs. Often the ground is littered with broken timber and dead logs, and it is difficult to walk through. Such a scrub may extend over many thousands of acres of good soil.

Plate 3.
Fence Line Cleared Through Thick Brigalow.

(*b*) Whipstick brigalow is a dense covering of brigalow regrowth, in many cases at least the result of bush fires in brigalow scrub country, sometimes following ring-barking. This country is practically useless for grazing.

(*c*) Gilgai brigalow, growing on gilgai or melon-hole country, is usually associated with belah; budda (sandalwood) and wilga are more or less plentiful. This is very good grazing country when cleaned up.

(*d*) Brigalow and yellowwood are commonly associated in some parts of the region, often on frontage country, and scrubs run back from the frontages and extend to high country. It may be on relatively open or thickly timbered country. On this type of country, usually in the dry part of the year, there may be considerable mortality among herds due to yellowwood poisoning.

Plate 4.
Yellowwood Scrub.

(*e*) Brigalow and blackbutt is a bad combination where growth is heavy, as when rung the whipstick variety of brigalow takes over.

(*f*) Flooded brigalow is found along frontages, in channel country and spreads, and it may be thick or open. The timber is usually tall and straight, and ring-barking results in a good kill. As a rule there is no great problem of regrowth provided the country can be protected from fires for several years after ringing.

(*g*) Open brigalow country consists of black and grey soils and has associations of bauhinia, myall, wilga, budda and gidyea. This type of brigalow exists as belts and patches throughout broken plain country and on the margin of frontage country ; it occurs on black, grey and red soils. This country is capable of good grazing, growing brigalow grasses as well as good stands of Mitchell, blue, Flinders and sago grasses and seasonal herbage. It lends itself to great improvement by judicious ring-barking.

5. Gidyea Scrub.

Gidyea scrubs are found in the area west of the Drummond Range. To some degree they have a role relative to that of brigalow on the eastern side, and like brigalow they may be open or dense and may constitute good or poor grazing country. The lightly timbered gidyea country and the relatively open country with gidyea clumps is the best fattening country in the region, carrying Mitchell and Flinders grasses, saltbush and herbage. Much of the frontage country of the Belyando River and its feeders is of this type.

6. Broken Plain.

Broken plain country consists of blacksoil plains broken by belts of timber. Quite often the plains are joined by necks of open country passing through or round the belts of timber. Brigalow is the dominant tree, but almost always has other species associated with it—wilga and bauhinia most commonly, often sandalwood, and according to the locality, sometimes yellowwood, bottle-tree, and kurrajong. On the coastal side of the Drummond Range this broken plain country forms a marginal area to the blacksoil downs, but this is not always so, as it sometimes occurs within an extensive area of brigalow scrub country. At its best the broken plain country ranks with the blacksoil downs as first-class grazing country, but sometimes these plains have a structureless ashy soil which makes inferior grazing.

Plate 5.
Flood Flats.

7. Frontage Country.

Frontage country is comprised of those strips of land, varying in width from a few hundred yards to 10 miles or more, in which are the main water-courses, their ana-branches and channels, and the "spreads." This country is subject to seasonal inundation, and in high flood some may be under 20 ft. of water. The spreads are so-called because in times of flood the water spreads slowly over the area (sometimes hundreds of acres in extent) to no great depth and with practically no current; as the main channels fall, the cover of water gradually recedes. This frontage country is the sweetest grazing and best fattening country in the region. Following the rainy season it provides luscious pasture, in which all the best grasses and herbage are represented.

8. Blacksoil Downs.

One of the most interesting areas, and potentially the greatest asset of the region, is the belt of black and brown clay soils extending from Rolleston in the south to the Suttor River in the north. This area comprises open and shaded blue grass plains and brigalow scrubs, and the whole is broken in an irregular manner by mountain spurs, sandstone ridges, and patches of lateritic and other soils.

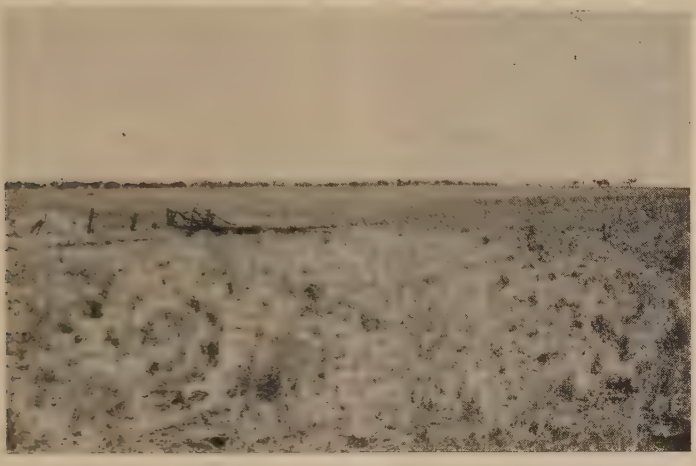


Plate 6.

Open Downs Country, Typical of That Being Used for Agricultural Purposes.

Plate 7.

Mitchell Grass Country in the Springsure District.

The soils under brigalow and the related type of scrub are very similar to those under grassland, except that the organic content is lower and the nitrogen is correspondingly lower.

The absence of frosts in the autumn allows late planting, so that advantage may be taken of the late summer rainfall, which is generally the most reliable, and this obviates the heatwave hazard for summer crops.

It is only within the last 4–5 years that crop production has been attempted on a more than experimental basis, and the results to date indicate that this area is capable of greatly increased production of beef by more intensive land utilization, which would include the growing of supplementary fodder crops, fodder conservation and improved permanent pastures. Without any cultural effort on the part of man, a prolific growth of excellent pasture is produced, which, if adequately watered and subdivided, will carry a mixed herd at the rate of a beast to 10–15 acres. For the most part the country is nicely shaded, and will produce Mitchell, blue, Flinders and sago grasses. Over the last 20–25 years the pasture of much of the Downs country has deteriorated, mint weed and other noxious plants taking the place of the original good vegetation.

9. Desert.

The desert country, so-called, is really a variety of forest, and in the Central Highlands occupies a strip of land of varying width from the Belyando River frontage to the western slope of the Great Divide. The soil is generally hard, reddish or grey, with numerous antbeds, mostly 3–4 ft. in height. The hard soil in places gives way to loose sandy patches. This country supports an open eucalypt forest, and sometimes a variety of shrubs. Much of the country has a good covering of coarse grasses, such as wire grasses and spinifex. Where water can be obtained desert country has a grazing value, but it can be used to best advantage only when worked in conjunction with better-class grazing country. The area is deficient in phosphate, and large parts of it are very dangerous due to the presence of heart-leaf poison bush.

PROPERTY IMPROVEMENTS.

Among graziers the unit of size of cattle properties is usually expressed as carrying capacity, or in other words, the size of its herd. In the Central Highlands, the properties vary in size from those running 500–600 head of cattle to those running 10,000–12,000 head. Most of the large properties are held by pastoral companies and meat exporting companies; the smaller properties (that is, those running up to say 3,000 head) are usually family units.

There is a great variation in the area of properties, which range from about 10,000 acres to 650,000 acres.

Property improvements of primary concern are the subdivisions and the watering facilities, and generally from the point of view of efficient cattle husbandry these are quite inadequate.

Fencing.

The three-wire fence, two barbed and one plain wire, is the standard subdivisional fence, and where the improvements are good this fence is reinforced at such vulnerable points as corners and for a number of panels on each side of a gateway. On those properties which formerly ran sheep, the internal fencing was of netting or six wires, and what lines of this fencing are used must be reinforced with barbed wires.

Water Supplies.

Supplementary water was supplied by sinking sub-artesian bores in the first instance, and latterly, with the advent of mechanical earth-moving equipment, by excavating earth tanks. In many parts of the Central Highlands the finding of an adequate supply of underground water fit for stock has cost many thousands of pounds.

The shallow underground water supplies formerly could be tapped at about 100 feet in many parts of the region, but these appear to have dried out. It is now necessary to go to 300–400 feet in this country for a comparable supply of water.

In some localities in the Alpha and Jericho areas it is necessary to bore as deep as 1,000 feet, and the supply of fresh water lies under one or more salt supplies which must be cut off by pressure-cementing the bore hole. On these properties the provision of sub-artesian water is a major capital outlay ; the equipment to lift the water has to be in keeping with the depth, and windmills as large as 24 ft. may be necessary.

Usually a 4 in. pipe with a draw-plunger pump is used. In this type of pump the working parts can be taken up to replace worn or defective parts without disturbing the pipe.

The water is pumped into galvanised iron storage tanks of 10,000, 20,000 or 30,000 gallons capacity, and by means of valve and float the flow is regulated into galvanised or concrete cattle troughs of 60–120 ft. in length.

In some cases an earth tank known as a turkey's nest tank is used in place of the galvanised iron tanks. These usually have a capacity of from 100,000 to 250,000 gallons. This large storage capacity is a big advantage, as it gives "breathing space" in the event of a breakdown in the bore-pumping equipment. Another advantage is that the turkey's nest tank is practically everlasting if it is constructed in the right manner.

Over the last decade there has been a revolutionary change in water supply improvements throughout the region brought about by the introduction of heavy earth-moving equipment and the excavation of earth tanks. These tanks range from 5,000 to 30,000 cubic yards capacity, the most common size being 10,000–15,000 cubic yards. The provision of dams has been an important factor in increasing the amount of available grazing country by bringing into production many thousands of acres of formerly dry country.

Timber Control.

Following on the improvements in water facilities and subdivision of the holding, successful ring-barking in certain areas is essential to attain maximum carrying capacity. On some properties in the brigalow scrub area a considerable amount of capital has been expended in ring-barking,

with varying results. Because of this the question of whether or not to ring-bark is a very controversial one among graziers, depending on the end-results of ring-barking on their respective properties. These have been generally :—

(*a*) 75–100% permanent kill, first-class pasture being obtained.

(*b*) Quite a good permanent kill, but deterioration of pasture.

(*c*) Thick regrowth, the last state of the ring-barked area being worse than the first.

Thus the time and method of ring-barking are difficult matters to decide, a number of interdependent factors affecting the issue. Of these may be mentioned the soil type, the type of brigalow and its associations, the season in which the ring-barking is carried out and the after-management of the ring-barked country.

Plate 8.
Regrowth of Brigalow.

A critical factor in the ring-barking of brigalow in this region is the prevention of fire through the area for at least five years after the ring-barking is completed.

There is a good deal of evidence to suggest that the prevailing method of ring-barking on a face is the least effective method of obtaining the desired result of a good kill and improved pasture, and a much better approach would be by a method of gradual thinning out over a period of several years, selecting first the largest and straightest trees, and treating not more than 25% of the timber in any one year.

Attention is now being turned to the clearing of timber by other methods such as bulldozing and poisoning from the air, and some landholders are making preliminary moves for trying these methods on a large scale.

Clearing by means of tractor and cable is being carried out in the brigalow country between Emerald and Gindie. A 30 h.p. crawler type tractor is used and $\frac{3}{4}$ inch cable, 30 yards long; one end of the cable is tied to a big tree and the tractor with cable attached is moved in a circle with the tree as the centre. The ground is ploughed immediately and put under sorghum.

This method may perhaps be improved by—

(1) Using a larger tractor (40 h.p.).

(2) Ringing the largest trees and allowing them to die before attempting to clear. This would make the operation cheaper and more efficient, because the lower the cable the better for the small timber, whereas the cable has to be relatively high on big trees to get them down.

(3) Using a ripper to take out roots before ploughing to help to control timber regrowth. This would be economical only where the land was to be used for agricultural purposes.

INOCULATION OF LEGUME SEEDS.

★ ★

The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are supplied free and post free. They are in bottles and have to be mixed with skim milk for sprinkling on the seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated.

ANIMAL HEALTH

Arsenical Poisoning of Stock.

R. G. MACDONALD, Assistant Veterinary Officer.

Of the various poisonous substances which cause fatalities in livestock, arsenic is probably responsible for more deaths than any other. Whereas plant poisoning usually has a seasonal occurrence, arsenic poisoning may be met with at any time of the year.

SOURCES OF ARSENIC.

Stock may obtain arsenic from any one of a number of sources, the most common of which are referred to below.

(1) *Arsenic Dips.*—As far as dips and sprays are concerned, too high a concentration of arsenic is a common cause of poisoning. To avoid this fault, arsenic dips should be tested regularly to ensure correct concentration. This may be done on the farm with a dip testing apparatus or samples may be sent to the Agricultural Chemist for analysis. The dip-side test does not, however, indicate the presence of oxidised arsenic, so that periodically samples should be sent to the laboratory of the Agricultural Chemist for a complete analysis. This is carried out free of charge.

The combination in a dip of arsenic and DDT in the form of a paste containing an emulsifier or wetting agent is dangerous, even when the arsenic is present in low concentration. This is considered to be due to skin penetration by the arsenic in the combination occurring more readily than when used alone.

All tins which have contained arsenic should be disposed of so that stock have no access to them. If they are left lying about the dip, stock frequently lick them.

Draining of cattle following dipping should be completed in pens at the head of the dip or in a small yard nearby. These small yards, if grassed, should be shut off from other stock, as grazing on grass contaminated with arsenic can cause deaths.

Dip fluid may be swallowed during dipping. In addition, arsenic may be absorbed through the skin. This is most likely to occur with sheep when they have been dipped straight off shears, the arsenic then being absorbed through cuts in the skin. It is also likely when cattle or sheep are dipped in hot humid weather or during light rain, more especially if they are driven any great distance before they can dry. In sheep, heavy rain following dipping washes the arsenic down close to the skin, the wool remains wet and this predisposes to absorption through the skin. Packing animals too tightly in the draining pen so that overheating occurs can also be responsible for arsenic being absorbed through the skin. During the mating season, it is not advisable to dip rams in arsenic, as the blood flow to the skin along the belly and inside the thighs is greatly increased and this aids in the absorption of arsenic. Such absorption, even if it does not cause death, usually has a serious effect on the ram's fertility.

Jetting with a solution of arsenic at too high a pressure forces the arsenic right down onto the skin, and

if the wool is short, the skin may be damaged, allowing the arsenic to penetrate.

(2) *Arsenical Weed Killers.*—Sodium arsenite and arsenic pentoxide are the most common preparations used in weed killers. Both are very poisonous. Most losses occur from stock licking discarded containers, which are left lying about. Other losses occur when stock stray onto railway lines, cemeteries, &c., where weeds are kept down by spraying.

(3) *Insect Sprays in Orchards.*—Lead arsenate is the common compound used in this work. The lead poisoning usually masks the symptoms due to arsenic.

(4) *Accidental Ingestion of Parasite Baits.*—Paris green (a compound of copper and arsenic) and white arsenic (arsenic trioxide) are commonly used in grasshopper baits.

(5) *Medicinal.*—Where animals are given small repeated quantities of arsenic in preparation for shows, &c., overdosing may occur, producing symptoms of chronic arsenical poisoning. The arsenic accumulates, as it is only slowly removed from the body.

A solution of arsenic is used by some people as a caustic, as in treating swamp cancer of horses. More than a pint of 1% arsenic trioxide solution, if applied to abraded or broken skin, may be toxic to domestic animals.

(6) *Industrial.*—In areas where the smelting or mining of copper or arsenic occurs, arsenic dust may settle out of the atmosphere onto foliage.

SYMPTOMS OF ARSENICAL POISONING.

The effects of arsenic do not become apparent until a few hours after it has been taken. It may even be much longer than this, depending on the amount involved.

Acute Form.

Where a large amount has been swallowed, there is a sudden onset of severe distress. There is evidence of severe abdominal pain, with restlessness, groaning, staggering and rapid respiration. The muscles tremble, saliva hangs from the mouth, and in the later stages vomiting may occur, as well as a fluid, foul-smelling diarrhoea. Sheep show very few symptoms except depression, rapid respiration and death. Death usually occurs 3-4 hours after the onset of the symptoms.

Subacute Form.

This occurs where smaller amounts have been swallowed, and the animals show symptoms for up to a week. There is usually marked weakness, incoordination and a severe diarrhoea, which often contains blood or mucus or both. This may change to constipation after two or three days. No food is eaten, but the animal is very thirsty. The membranes of the eyes and mouth are a brick-red colour, and the pupils of the eyes are dilated. The animals eventually become unconscious and die, sometimes with struggling.

Chronic Form.

This is not seen very often and most cases are reported from about mines and factories. The appetite varies. On some days affected animals will eat, on others they will not. They have occasional bouts of indigestion, with diarrhoea or constipation. These frequently alternate. They have occasional attacks of abdominal pain, with kicking at the belly. They slowly lose condition, hair falls out, and milk yield falls and eventually stops. There may be inflammation of the eyes and swelling of the eyelids. The membranes in the mouth and nose become sore and ulcerated.

Skin Form.

This is seen where a heavy dose of arsenic has been absorbed through the skin. A general upset with symptoms described above may or may not be seen as well. The gait is stiff, the hair falls out, and the skin is reddened and eventually peels off in hard leathery flags, leaving raw wounds that are hard to heal.

POST-MORTEM FINDINGS.

The most obvious findings in sheep and cattle are in the fourth stomach and the first foot of the small intestine. These have a general rose-pink colouration and usually a few ulcers are scattered over the surface. This condition may also be found in the first part of the large intestine. In some areas the lining of the gut will have peeled off or else it may be peeled off by hand quite easily. The contents of the stomach and small intestines are very fluid and contain mucous and shreds of lining of the gut. If the gall bladder is opened, the lining membrane is nearly always seen to be acutely inflamed.

In the chronic form, the colouring in the stomach and intestines is not so intensive, but small ulcers are usually seen.

DIAGNOSIS.

This is based on—

(1) History of the animal's access to arsenic.

(2) Symptoms outlined above.

(3) Chemical analysis of specimens obtained at post-mortem examination.

The specimens desirable for analysis in the case of ruminants are—

(1) 2 lb. paunch (rumen) content.

(2) 2 lb. fourth stomach (abomasum) content.

(3) 1 lb. liver.

(4) One whole ox kidney or both sheep kidneys.

(5) Urine—if available.

TREATMENT.

Unfortunately, treatment is often not satisfactory, especially if a large amount of arsenic has been swallowed, or if symptoms have been in evidence for some time.

The initial treatment, which should be carried out as soon as possible after a diagnosis is made, consists of administering 2 oz. of sodium thiosulphate (photographic hypo) in ½ pint of water, as a drench. This is the dose for cattle and horses. It may be repeated two or three times during the next 24 hours, and if necessary the following day. For sheep and pigs the dose is ¼–½ oz. given in a small quantity of water.

Best results follow if some hypo is injected, in addition to that given as a drench. The injection is better if given intravenously but may be given subcutaneously. The dose for an injection is 20 c.c. to 30 c.c. of a 20% solution, made by dissolving 1 oz. of hypo in 5 fluid oz. of water, boiling and allowing to cool. For the sheep or pig, 5 c.c. of this solution will suffice.

If poisoning is believed to have occurred as the result of arsenic being absorbed through the skin, the affected animals may be sprayed with a 5% hypo solution made by dissolving 1 lb. hypo in 2 gallons of water.

After administering the hypo a purgative should be given. An oily purge such as raw linseed oil is best. Give cattle 1-2 pints, sheep 4-6 fluid oz. If lime water is available, mix an equal quantity of it with the linseed oil purge. Lime water is prepared by dissolving slaked lime in rain water until no more will dissolve. The excess lime is allowed to settle out and the clear lime water poured off.

After the purge has been given, allow the animals to rest, if possible in a sheltered paddock with ample shade. Lime water or milk may be given as a drench, giving a quart 3-4 times a day for 2-3 days. This helps to protect the lining of the intestines.

Avoid disturbing affected animals any more than is necessary. They get very weak and require rest and comfort in addition to medicinal treatment.

Using Home-grown Food for Pigs.

F. BOSTOCK, Officer in Charge, Pig Branch.

The pig, with its relatively small stomach, is unable to cope with large amounts of the bulky fibrous foods commonly fed to cattle and sheep. It requires a diet mainly composed of highly digestible foods, although it can deal with limited amounts of fibrous foods.

The cheapness of feed grains before and during the early years of the war and the ease of feeding an all-meal ration encouraged farmers to feed increasing quantities of purchased foods and provided little incentive to utilize home-grown foods. With the increase in price of feed grains to-day, the pig farmer should plan to supplement the purchased grain allowance with home-grown cereals and root crops in order to build up the returns from the pig-raising project.

The extent to which this can be done will depend upon the relation between the price of purchased meals, or feed grain, and the production cost of home-grown foods; also on the degree to which home-grown foods may be used to replace purchased meals, &c., without reducing the efficiency of the pig as a meat producer.

To do this certain precautions must be taken, and in Table 1 two rations, each designed to meet the requirements of the pig being fed from 30 lb. to 200 lb. liveweight, are compared.

It is felt that any reduction in the food bill should be an inducement to pig producers to try and replace purchased grain with home-grown foods, but the extent to which this may be done depends on the skill of the farmer and the quality and area of land available to grow suitable crops.

Most farmers are interested in increasing the income from their farm, and the introduction of a pig project or the expansion of one already established may be one way to accomplish this.

Production is still low and farmers would be making a real contribution to our meat supplies by producing more home-grown foods and feeding them to pigs.

TABLE 1.

Costs of Rations with and without A Home-grown Root Crop.

Age Weeks.	Liveweight of Pig.	No. 1 Ration.		No. 2 Ration.		
		Purchased Meals per day.	Meatmeal.	Purchased Meals per day.	Meatmeal.	Sweet Potatoes per day.
	lb.	lb.	lb.	lb.	lb.	lb.
9	30–34	1½	¼	1½	¼	..
10	34–39	1¾	½	1¾	½	..
11	39–44	2	½	2	½	..
12	44–50	2¼	½	2¼	½	..
13	50–56	2½	½	2½	½	..
14	56–63	2¾	½	2¾	½	..
15	63–70	3	½	3	½	¾
16	70–77	3¼	½	3	½	1¼
17	77–84	3½	½	3	½	2½
18	84–92	3¾	½	3	½	3½
19	92–100	4	¼	3	¼	4½
20	100–108	4¼	¼	3	¼	5½
21	108–116	4½	¼	3	¼	6½
22	116–125	4¾	¼	3	¼	7½
23	125–134	5	¼	3	¼	9
24	134–143	5¼	¼	3	¼	10
25	143–152	5½	¼	3	¼	11½
26	152–161	5¾	¼	2	¼	17½
27	161–170	6	¼	2	¼	20
28	170–179	6½	¼	2	¼	20
29	179–188	6½	¼	2	¼	20
30	188–197	6½	¼	2	¼	20
31	197–206	6½	¼	2	¼	20
Total feed for period		680·75	56	404·25	56	1,260
Cost		(14s. per bush.) £7 19 0	(£25 12s. per ton) 12s. 10d.	(14s. per bush.) £4 14 6	(£25 12s. per ton) 12s. 10d.	(£2 per ton production cost) £1 1 0
Total		£8 11 10		£6 8 4		

A saving of £2 3s. 6d. (3·72d. per lb.) for 140 lb. dressed weight carcase is shown.

Note.—In addition, clean drinking water should be available at all times and green feed cut and fed at the rate of 1½ lb. per day or good grazing provided.

LICENSING OF KANGAROO SHOOTERS.

With the recent declaration of the Fauna Conservation Act of 1952, it became necessary for all kangaroo shooters and dealers in kangaroo skins to take out a license, which must be renewed annually.

The unrestricted shooting of kangaroos in past years had made it desirable to introduce some form of supervision of the kangaroo skin industry, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said when making the announcement.

Applications for licenses, and the payment of the royalty which now applies to all kangaroo skins sold, should be made to the Department of Agriculture and Stock, Brisbane.

The Manufacture of Cheddar Cheese in Queensland.

E. B. RICE and T. A. MORRIS, Division of Dairying.

(*Continued from page 62 of the January issue.*)

THE RIPENING OF CHEDDAR CHEESE.

The Process of Ripening.

The term "ripening" is applied to the process by which the initially indigestible and relatively flavourless curd is changed into wholesome and nourishing cheese. This process is not a simple one, but rather a combination of several chemical and enzymatic changes. Cheese flavour cannot be attributed to one particular substance, nor can it be held to be the result of a single action.

The main agents in the ripening of cheddar cheese are rennet and lactic acid bacteria.

Rennet extract contains a peptonising enzyme which is capable of breaking down the cheese protein to simpler nitrogenous compounds which are soluble in water. This is the mechanism by which the increased digestibility of the curd is brought about.

The action of the enzymes in rennet takes place only in a neutral or acid medium. The rate at which the protein is broken down is related to the degree of acidity of the cheese. Thus sweet cheese will retain its rubbery body longer than acid cheese, which tends to develop a weak and pasty body. The sweet cheese will eventually lose its curdy body as the action of the enzyme slowly proceeds. It is therefore apparent that attaining the correct degree of acidity in cheese is very important. The lactic acid streptococci of the starter are the initial acid producers during the manufacture of the cheese. They attain their maximum numbers by the time the cheese is about one day old and thereafter decrease and die out in 10–14 days, due to the unfavourable conditions of high acidity, high salt and low lactose concentration.

Acting under the stimulus of the high acidity produced by the streptococci, the rennet enzyme responsible for the degradation of the protein produces breakdown products such as peptones and polypeptides. These substances are conducive to the growth of another type of lactic acid producing organism, known as the lactobacilli. These organisms, originally present in the milk and cheese in low numbers, rapidly multiply when conditions become favourable for them. They are largely responsible for the development of the flavour of cheddar cheese, which is thought to be due to the by-products of the bacterial activity.

The appearance of certain volatile organic acids in cheese during ripening cannot be ignored in a consideration of the development of cheese flavour. These acids are formed by bacterial and enzymatic action on the lactates and the fat and protein of the cheese, and they themselves, or some of their derivatives, probably play a part in the production of the flavour and aroma of cheese.

Another occurrence during ripening of cheese is that of loss of moisture. Evaporation from the surface of cheese causes a shrinkage in the size of the cheese as it gradually dries out. The loss of moisture is most rapid during the early life of the cheese.

Factors Affecting the Rate of Ripening.

In view of the nature of the ripening process, it is natural to suspect that some factors retard the rate of ripening and others accelerate it. The factors influencing the rate of cheese ripening are :—

(1) The amount of rennet used.

(2) The acidity.

(3) The moisture content of the cheese.

(4) The salt content of the cheese.

(5) The temperature of curing.

(1) *The Amount of Rennet Used.*—The rate of protein breakdown is directly related to the amount of rennet used. The greater the quantity of rennet, the faster does the cheese lose its rubbery body. Excessive rennet may cause weak, pasty-bodied cheese which is often bitter, while too little rennet, besides prolonging the time required to set the milk during manufacture, may be responsible for slower ripening of the cheese. Thus slightly higher than normal amounts of rennet may be an advantage if cheese is being manufactured for local sale or when the cheese is being cured at low temperatures.

(2) *The Acidity.*—The effect of the acidity of the cheese on the rate of ripening has already been detailed.

(3) *The Moisture Content of the Cheese.*—The effect of the moisture content of the cheese on the rate of ripening is twofold. As well as having a direct influence, there is an indirect effect in that the acidity of the cheese may vary according to the moisture content. The bacterial and enzymatic action which occurs during ripening takes place at a faster rate in cheese with a high percentage of moisture in the fat-free-substance than in cheese with a low percentage. Cheese which has a high moisture content is also inclined to develop a high acidity which favours rapid protein breakdown.

(4) *The Salt Content of the Cheese.*—This should be considered as the percentage of salt in the moisture in the cheese. The normal salt content of cheese has a retarding influence on the ripening process. Cheese with a high salt-in-moisture content will ripen more slowly than that with a low salt-in-moisture content. More than 5·5% salt-in-moisture is considered to unduly retard ripening.

(5) *The Temperature of Curing.*—As in the case of most chemical reactions, the ripening of cheese proceeds, within certain limits, at a faster rate when the temperature is higher. Low temperatures prolong curing but retard the development of off-flavours. Holding good cheese at 60° F. for the first four weeks (as against 45–50° F.) gives a quicker rate of ripening, but off-flavours are accentuated in cheese of lower quality.

Moisture Loss During Ripening.

Shrinkage of cheese occurs through the loss of moisture by evaporation from the surface, particularly during the first few days after the cheese is made. The extent of the loss of moisture from cheese during curing depends on several factors, as will be seen later, but a shrinkage in the green cheese weight of about 1·5% at 14 days and 6% at 3 months is an approximate figure for average conditions.

The factors affecting the shrinkage of cheese are :—

(1) The moisture content of the cheese.

(2) The temperature of the curing room.

(3) The humidity of the curing room.

(4) The size and shape of the cheese.

(5) The texture of the cheese.

(1) *The Moisture Content of the Cheese.*—The higher the moisture content of the cheese, the greater will be the amount of shrinkage, owing to the tendency of the cheese to dry out to a certain percentage of moisture in the fat-free-substance.

(2) *The Temperature of the Curing Room.*—High temperatures cause rapid evaporation of moisture and thus high rates of shrinkage. It is estimated that an increase of 1% in the shrinkage occurs over a period of 3 months for each 5° F. in excess of 55° F.

(3) *The Humidity of the Curing Room.*—The higher the moisture content of the air, the greater is the resistance to further evaporation. Thus a high relative humidity in a curing room will prevent a certain amount of shrinkage in cheese stored in the room.

(4) *The Size and Shape of the Cheese.*—A small cheese has a greater surface area in relation to its weight than a larger cheese of the same shape, and consequently evaporation is correspondingly greater. Round cheese have a smaller surface area than square cheese of the same weight.

(5) *The Texture of the Cheese.*—Moisture can more readily escape from open-textured cheese than from close-textured cheese.

Cheese Curing Rooms.

In most Queensland factories the cheese is held only for about 14–21 days at the factory before despatch to cold stores. The room in which it is held may be regarded simply as a holding room. Usually this room has double walls, floors, ceilings, windows and doors, insulation being secured by means of a 4–6 in. thickness of insulating material, such as cork, sawdust, charcoal, etc. Refrigeration is being increasingly used to control the temperature of factory holding rooms, but many factories still depend for temperature control upon opening the doors and windows of the holding room at night and keeping the room shut up in the daytime. Ventilation is required to allow humidity control and prevent mould growth in the room.

Temperature and Humidity in Curing Rooms.

In view of the effect which temperature and humidity have on cheese ripening and loss of moisture, it is important that they should be controlled as far as possible. This presents a problem because of the high summer temperatures in this State and the comparatively dry atmosphere of the main cheese-producing areas. The objective should be to maintain a temperature not higher than 70° F., but under practical conditions with uncooled rooms this is difficult to achieve. Well made cheese held at 70° F. for the first fortnight in the factory will not be adversely affected, though if held longer at this temperature, deterioration occurs. Cheese which is to be kept for the mature cheese trade should be maintained at about 50° F. after despatch to the cold stores at 2–3 weeks old. The relative humidity in the holding room should be 80–85%. Higher humidities are too conducive to mould growth, while lower humidities allow too much loss of moisture.

The cooling of cheese holding or curing rooms without controlling the humidity is unsatisfactory from the point of view of shrinkage and mould control. The ideal is the automatic control of both temperature and humidity at their optimum level. The equipment for attaining this control (Plate 18) can be obtained and its wider use in Queensland is probable. In New Zealand considerable success has been obtained with automatic temperature and humidity controls operated to give a temperature of 55° F. and a relative humidity of 83%.

Care of Cheese Curing Rooms.

Many factory curing rooms have no temperature or humidity controls and thus much attention has to be given to the opening and closing of ventilators and the control of mould growth.

Heavy mould growth on cheese not only spoils its appearance but also increases the amount of wastage. With proper attention to the curing room, mould trouble can be kept to a minimum.

The following points should be noted :—

(*a*) Avoid, as far as possible, high humidities and high temperatures in the room.

(*b*) Provide a means of circulating the air in the room. Moving air carries away the moisture vapour surrounding the cheese and so makes conditions less conducive to mould growth.

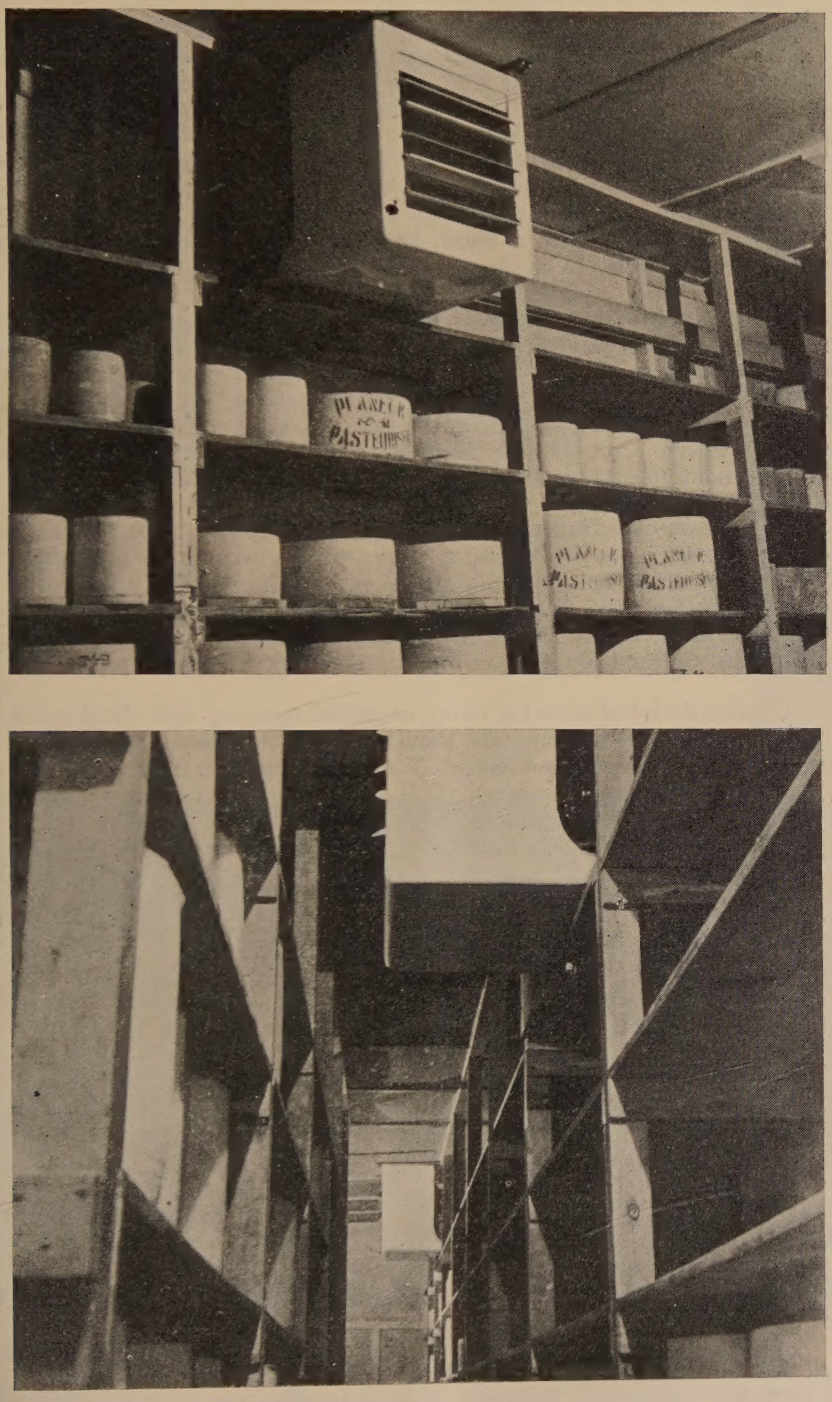


Plate 18.

Internal Air Conditioning for a Small Curing Room. For a larger room the cooling units shown would be installed in ducting to circulate the conditioned air throughout the room.

(*c*) Do not store bandages and caps in the curing room, where they are exposed to mould contamination. A closed cupboard in a dry part of the factory is the best place for such material.

(*d*) Keep the cheese shelves clean. It is particularly important that green cheese should not be placed on shelves which have not been cleaned after the removal of older, mould-covered, cheese. Wiping down shelves with a cloth soaked in a strong solution of hypochlorite a short time before placing green cheese on them helps to check mould growth.

The periodical burning of sulphur in the closed room will help to reduce mould trouble but because of the nature of the fumes evolved it is a rather unpleasant method of control. In overseas experiments, ozone in concentrations as low as one part per three million has been found to be effective in preventing mould growth. However, the ozonising unit is regarded as being expensive and proper temperature and humidity control have advantages additional to that of mould control.

In the case of curing rooms used for mature cheese, mite trouble may be experienced. The best means of preventing this is to maintain the cheese curing room in a meticulously clean condition. The elimination of all cheese residues and fragments of old cheese should be a daily practice. Old cheese, and for that matter any cheese, entering the curing room should be carefully checked for signs of mite infestation.

If mites do infest a curing room, atomised spraying with dichloroethyl-ether will do much to eliminate them, but this substance may taint the cheese if adequate care is not taken. For this reason, it is desirable to empty the curing room before spraying. It is very important to ensure that only mite-free cheese is then placed in the room.

[TO BE CONTINUED.]

WARNING ON DIPPING OF CATTLE.

Deaths in cattle following the use of strong mixtures of arsenic and DDT in dips and sprays have occurred from time to time and frequent warnings of the danger of mixing these emulsions have been issued by officers of the Department of Agriculture and Stock. These losses are caused by the increased absorption of arsenic through the skin when mixed with DDT emulsions leading to death from arsenical poisoning.

Charging dips with a mixture containing low concentrations of both arsenic and DDT is frequently practised, but this method has little to recommend it and is potentially dangerous. Redipping at short intervals can, in these cases, cause deaths from arsenical poisoning. However, there is no evidence that dipping in DDT followed by dipping in arsenic at a normal dipping interval is dangerous, or that a light spraying with DDT for the control of buffalo fly following arsenical dipping is harmful.